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TRAFFIC ENGINEERING & CONTROL

VOLUME 3 No. 1 MAY 1961

The only British monthly devoted exclusively to traffic engineering.

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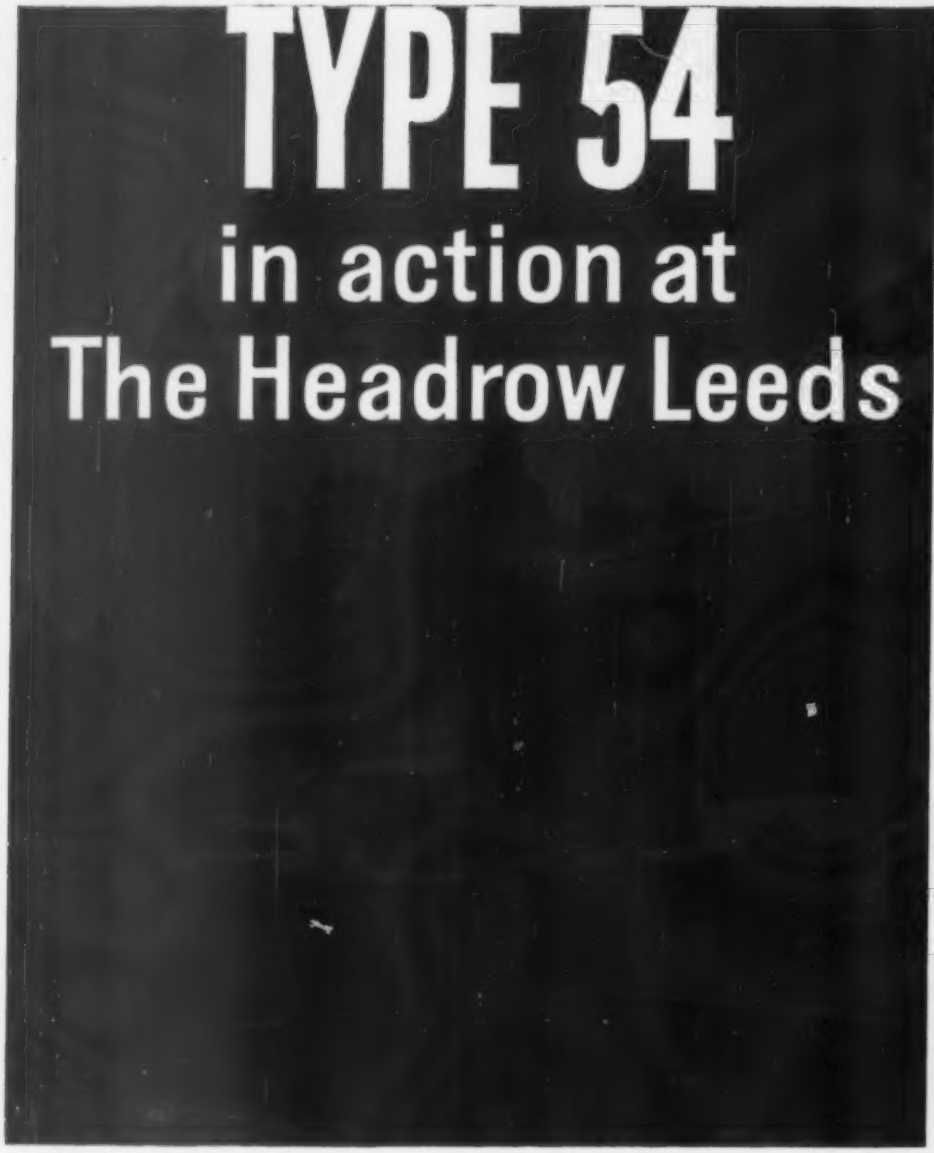
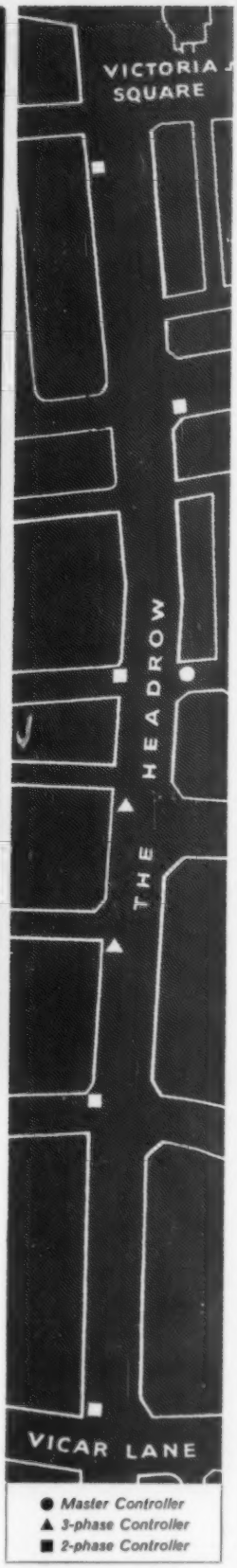
TYPE 54
in action at The Headrow Leeds



The Town Hall — Victoria Square



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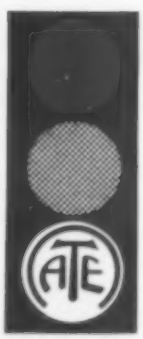

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Our First Anniversary

WITH this issue, *Traffic Engineering & Control* enters its second year. The first issue, May 1960, set out the purpose of the Journal, its aims and objectives. In brief, these were to make more widely available the methods and techniques of traffic engineering and to create a greater awareness of the results obtained from their application and from road and traffic research. It is for our growing readership to judge the extent to which this purpose is being fulfilled, but the representative team responsible for striving to achieve these objectives—the honorary Editorial Advisory Board, Consultants, staff and contributors—have been gratified at the reception the Journal has received and the wide recognition given it at home and overseas as being authoritative and responsible in its specialized field. Admittedly, initially doubts were entertained as to whether the standards set could be maintained and whether it might not prove difficult to obtain a steady flow of material of use to the practising traffic engineer, research workers, students and others concerned with the planning of road networks and the control of traffic. In the event, the co-operation received from those working in the field, including the Ministry of Transport and local government officers, from the Road Research Laboratory and the universities, has greatly assisted us editorially.

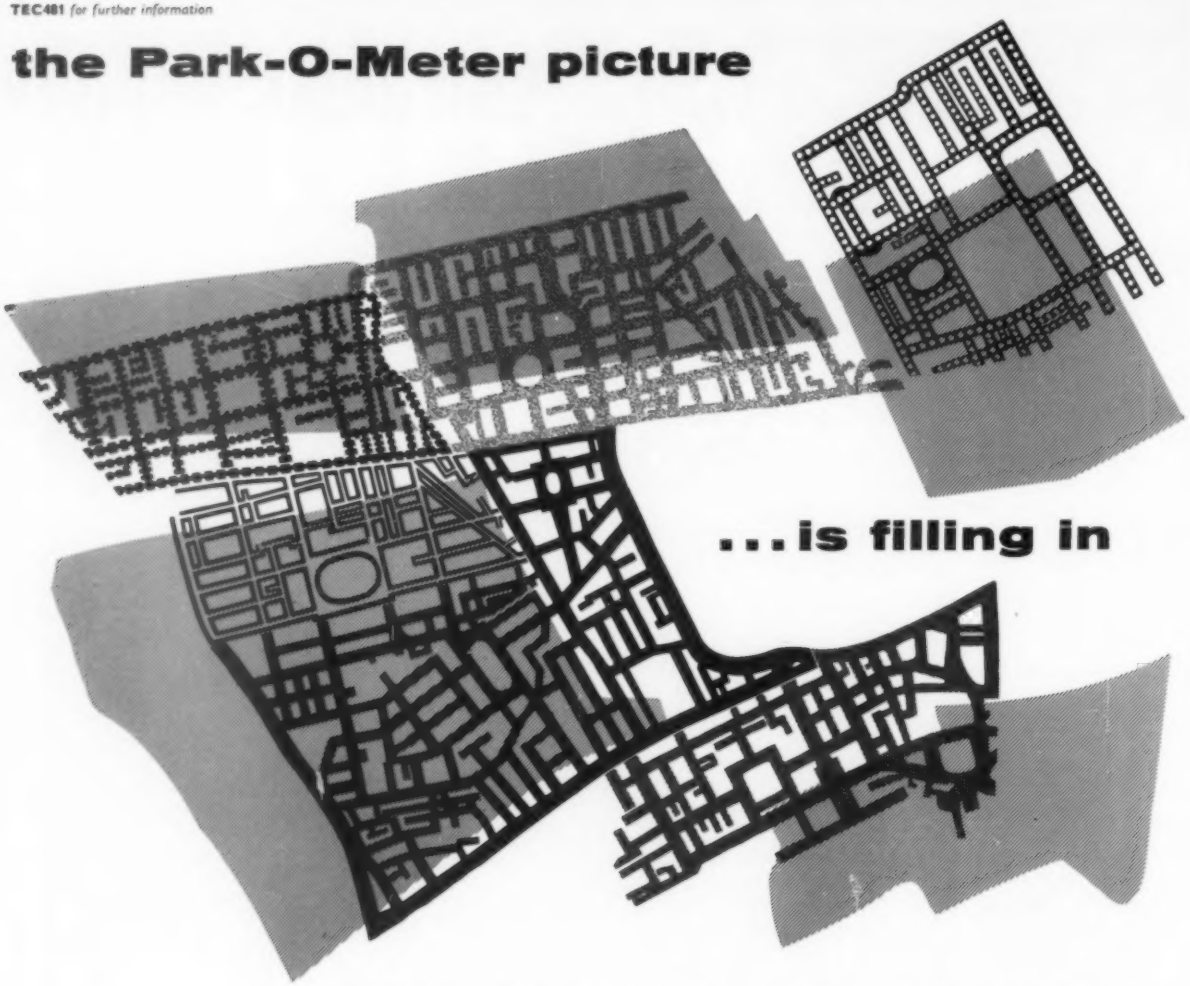
The Journal appeared at an opportune time because during its first year there has been an increasing awareness of the contribution that traffic engineering can make towards the solutions of the problems arising from motorization. This is evidenced by the use of traffic engineering to an increasing extent by a greater number of authorities in their attempts to solve their traffic congestion problems and to achieve a smoother traffic flow.

The successful and well attended traffic symposium at Kings College, Newcastle upon Tyne, University of Durham, held in collaboration with the Roads Campaign Council last month, also shows a desire not only for greater knowledge of traffic engineering itself but also for a clearer definition of its scope and place in planning urban redevelopment. At this symposium the warnings sounded in our first editorial were repeated, namely, that not too narrow an interpretation should be placed on the functions of the traffic engineer, that he could not provide a panacea for all traffic ills and that he should not work in isolation. The fact that the symposium was sponsored by the joint departments of Architecture, Town and Country Planning and Civil Engineering of the University is evidence of the acceptance of this view, and the contribution of Mr. Colin Buchanan, Urban Planning Adviser to the Ministry of Transport, with his plea for the comprehensive replanning of urban areas on the basis of what he termed 'traffic architecture' endorsed it. He warned that motor traffic, for all its utility, threatens to play havoc with the basic civilized value of our towns and endangered the continuance of the whole tradition of urban living. His contention that urban traffic is wholly related to buildings and that the planning of roads and of land use are inseparable is indisputable. Consequently, urban renewal provides equally the opportunity for comprehensive redevelopment incorporating the planning of traffic, for the arranging of buildings for the efficient circulation within that environment which the community prefers. Unfortunately, the responsible departments are slow in giving guidance and in an editorial in our March issue comment was made upon this. Within the two Ministries concerned there appears to be no sense of urgency in laying down the principles to be followed and the standards to be set for urban renewal.

As *Traffic Engineering & Control* starts a new year with Volume 3 (Vol. 2 was in effect the first volume because Vol. 1 was only a dummy produced for purposes of registration and protection of copyright) much remains to be done. In his article Mr. John Hay, M.P., Joint Parliamentary Secretary to the Ministry of Transport reveals how few highway authorities are as yet employing either traffic engineers or fully applying traffic engineering to the extent current knowledge makes possible. At Newcastle, Mr. A. J. Duff, Senior Engineer at the Ministry of Transport, stated that steps are being taken to encourage the greater use of traffic engineering and a memorandum giving advice on its methods and techniques is being circulated. This is all to the good and, unquestionably, during this Journal's first year traffic engineering in this country has made much progress. There is, however, still need for far greater opportunity for the technical training of traffic engineers, for their greater employment and their status needs to be defined and raised.

The aims and objectives of this Journal, therefore, remain as stated in May 1960, but opportunity has become greater to disseminate more widely the information as to the contribution traffic engineering can make and is making. In carrying out this task we invite the co-operation of our readers both at home and overseas. On the one hand, we invite them to assist us by providing information of the work they are doing so that our readers can learn from their experience, and, on the other, to suggest ways in which they consider this Journal can serve their interests better. Contributions, criticism and suggestions will always be welcome.

the Park-O-Meter picture



The success of these pioneer schemes is a clear pointer to the future.

- City of Westminster. 625 Park-O-Meters in operation since July 1958.
- Borough of St. Marylebone. 466 Park-O-Meters in operation since June 1959.
- City of Westminster. 1,209 Park-O-Meters in operation since April 1960.
- Borough of Holborn. 670 Park-O-Meters in operation since October 1960.
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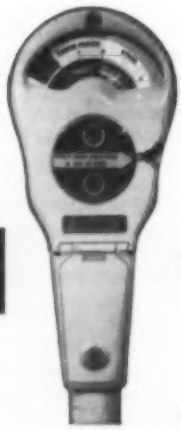
- Borough of St. Marylebone. 726 Park-O-Meters in operation since November 1960.



By the end of 1960, the total number of Venner Park-O-Meters in London exceeded 4,500. Already, the three most recent installations are making a useful contribution towards speeding the flow of traffic, and will greatly augment the funds available for off-street parking developments.

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Topics of the Month . . .

THE symposium on 'Urban Survival and Traffic' at Newcastle upon Tyne did not set out to reach any final conclusions, but from the papers presented and the discussion that followed certain interesting and valuable common lines of thought emerged. These included first, that long-term planning of traffic cannot be undertaken apart from comprehensive urban redevelopment: that its planning in relation to land use is essential if the motor vehicle is to serve rather than destroy our traditional way of life. Second, that such planning must be teamwork with the architects, planners, city, highway and traffic engineers, valuers and economists having equal voice. Third, that, where possible, to make life in urban areas pleasanter, heavy traffic should be separated from where people live. Fourth, that future traffic planning, with its aim of minimizing or removing those conflicts which cause congestion and impede traffic flow and add to the danger on the roads, must provide for segregation, particularly of pedestrians and vehicles, preferably and where appropriate, at separate levels. Fifth, that all planning should provide for public transport which cannot be dispensed with. Sixth, that great as is the contribution that traffic engineering can make, its ability to solve traffic congestion within the confines of existing road networks is limited: traffic flow can be eased and street capacity raised in the short-term, but in the long-term without new construction on a considerable scale traffic engineering in itself cannot possibly provide adequately for the growth in motorization. Seventh, that the field for traffic study needs to be extended from the collection of data on current traffic pattern and behaviour to the more comprehensive studies of every facet of community life in relation to transport.

The Newcastle conference, bringing together well over a hundred representatives from the respective professions, provided a forum for the exchange of ideas and experience and marks an important step forward in thinking in regard to traffic and its place in urban life.

Redevelopment at Newcastle upon Tyne

THE plan for the redevelopment of the central area of Newcastle upon Tyne, presented last month by the City Planning Officer, Mr. William Burns, is a fine example of planning along the lines discussed at the symposium. It attempts to keep the best of the old development of the city and to integrate the new so as to ensure continuity. It accepts that traffic solutions can only be found if traffic that has no need to penetrate the central business district is carried on limited access urban motorways with adequate provision for distribution within the business area of the traffic destined for it. Within the central area, shopping precincts are to be provided with pedestrian segregation and ample provision made for car parking. Finally, the plan as a whole attempts to sort out the various conflicting land uses into a logical pattern for development. At the same time, full provision is made for public transport and encouragement of its use. More specifically, the plan provides for a central motorway system for distributing fast moving vehicles with the number of junctions kept to the minimum and intersections at different levels. An inner local circulation system is proposed for cars and for vehicles circulating within the inner core of the central area and giving access to car parks. Within this inner circulation system, pedestrian precincts are to be provided with pedestrian ways at different levels from the traffic and the car parking areas. It is planned to bring public transport as close to the shops and business areas as possible by reserving certain streets for it and, elsewhere, for all loading points to be in loading bays. It is proposed to publish extracts from the City Planning Officer's Report in the June issue of this Journal.

Road Traffic Bill

IT is most regrettable that the Road Traffic Bill has been introduced so late in the Parliamentary session since it is doubtful whether this long, complicated and controversial measure can be piloted through its various stages before Parliament adjourns for the long summer recess. Even if it emerges from the House of Lords, where the debate on second reading showed it would have no easy or speedy passage, it has to get through the House of Commons where its committee stage is certain to be protracted. In the circumstances, it might have been better had the Bill been held over until next session to enable more consideration to be given to its provisions and more time allowed for consultation with those most concerned. As it is, certain of its provisions, if carried onto the statute book, may prove of doubtful value in that they may not achieve their purpose of deterring drivers from bad road behaviour. In particular, the raising of the penalties for minor offences, even to the point of disqualification from driving if three convictions are obtained in two years, appears unreasonable. The law cannot be effective without the co-operation of drivers, which cannot be obtained as long as regulations are considered unjustified and penalties unjust.

While many of the changes in the present law proposed in the Bill are desirable and overdue, the general approach is not necessarily the right one. It is still assumed too readily that the driver is mainly responsible for road accidents and that the more severe the penalties the fewer the accidents. There is no evidence for this, and a more scientific approach is called for. The vehicle and the condition of the road are frequently contributory factors, at least, and the speeding up of the introduction of compulsory testing of all vehicles on the one hand, and a greatly extended programme for the elimination of black spots and of new construction and major improvements, on the other, might contribute more to the reduction of road accidents than any number of Road Traffic Bills of this type.

PROGRESS IN TRAFFIC ENGINEERING

by John Hay, M.P.
Joint Parliamentary Secretary, Ministry of Transport

THE past year has been an important one for traffic engineering in this country, and the first anniversary of *Traffic Engineering and Control* gives a good opportunity to take stock of progress.

In the first issue, the Editor's purpose was defined:

> to make more widely available the methods and techniques of traffic engineering, to create a greater awareness of the results obtained from their application and from road and traffic research.

Traffic Engineering was defined as being:

> directed at enabling the maximum capacity to be obtained from roads and traffic networks, from the construction of new roads and the improvement of old ones, and from the regulation and control of traffic.

The Minister of Transport is in full sympathy with these aims. It is his intention to promote them in those areas where he has the direct responsibility, and to encourage their use by highway authorities elsewhere.

The types of activity in which traffic engineering is applicable are extremely widespread. They range from the major elements of the road programme, where traffic studies are an essential basis of new schemes, to individual measures in a particular locality.

The Government measures put into effect during the past year show clearly the build-up of momentum in this field.

(1) When the first issue of *Traffic Engineering and Control* was published, the *Road Traffic and Roads Improvement Bill* was at an early stage of its Parliamentary course. It did not receive Royal Assent until July 29, 1960. Both in the London area and in the provinces its provisions are likely to be progressively beneficial both in the field of parking policy and of traffic measures.

(2) *The London Traffic Management Unit* was at that time forming. It is now virtually complete, and has gone into action. Its duty is to apply the most modern traffic engineering techniques to the problems of London traffic. The Unit's immediate tasks are:

(*a*) To improve circulation on the network of major streets in Central London.
(*b*) To improve selected radial and circumferential routes leading to and around Central London.
(*c*) To deal comprehensively with street parking in Central London.

The Tottenham Court Road/Gower Street one-way system and the peak-hour clearway on the Cromwell Road are prototype experimental schemes which are proposed for introduction this year. Further major schemes are at an advanced stage of preparation.

(3) *The Road Programme.* In July 1960, the Minister announced a substantial increase in the road programme. Work on the five major projects is to be accelerated so that they will be substantially completed—and a start made on the London-Yorkshire motorway—in the next five years. Over the same period, Government expenditure on classified roads in England and Wales—with

Fig. 1. Brook Street, Mayfair, before installation of parking meters, showing how double banking was reducing the carriageway width to one traffic lane.

particular emphasis on work designed to relieve urban congestion—is to be doubled and will run at £150 million. This means, among other things, that in the County of London an annual programme of £10 million is now possible; while in the provincial conurbations the co-ordinated planning and execution of road improvements will be given a fresh impetus.

(4) *Traffic Surveys* are planned or under way in many of these areas. In London, the Ministry and the L.C.C. are co-operating in arranging a full scale origin and destination survey of traffic in the Greater London area. This will provide for the first time adequate scientific information needed to plan London's roads, not only for the immediate future but also for the longer term. Consultants have been retained to advise initially on the form of the survey. Large traffic surveys have also been commissioned in Glasgow, Liverpool and Manchester, to name only three outstanding cases. Emphasis has also been laid on the importance of traffic engineering and management in the Report of the Royal Commission on Local Government in Greater London.

(5) *Control of parking*, where effective action can produce immediate and striking results, is an essential part of the total traffic engineering plan. It is our firm policy that long-term parkers must be progressively cleared from congested roads and the roads restored to their proper use—the movement of traffic. Parkers, both short- and long-term, must accustom themselves to paying an economic charge for the space which they occupy.

The most effective instrument of street traffic control so far employed is the parking meter, which is being introduced increasingly in Central London and which is beginning to appear in provincial towns and cities and in the outer London suburbs. The spread of parking meters, together with the introduction of traffic wardens and ticket fines, has by common consent greatly improved the situation in Central London. Figs. 1 to 4 illustrate this graphically. To these must be added the experiment being conducted by the Commissioner of Metropolitan Police in the Central Area which restricts to commercial vehicles the right to load and unload outside designated parking places. The results of this experiment are being closely examined as a guide to future action. But it can be said at once that the police have been impressed with its success.

(6) Finally, in this account of developments in the past year, mention must be made of the increased provision of *off-street parking*. In London, the City and the Metropolitan Boroughs are bringing forward very substantial plans. The Government, as a symbol of their determination to assist in this problem, have introduced a Bill to enable an underground car park for 1,100 cars to be provided under Hyde Park. This Bill has been given a second reading in the House of Commons and is now pursuing the later stages of its course through Parliament. Ideally, parking meters and off-street parking facilities should be provided simultaneously. But if this cannot be done, the traffic situation often requires that street controls should precede the provision of garages. Indeed in such cases the substantial investment required to build adequate off-street parking facilities may not prove viable until the practice of using the highway as a free garage is effectively curtailed.

Fig. 2. Brook Street, Mayfair, after parking meters came into operation, showing ease with which commercial vehicles can wait in kerbside loading gaps.

Fig. 3. Grosvenor Square, Mayfair, before the parking meter scheme was in operation, showing three lines of parked vehicles, one of which is doubled banked, making access impossible.

It may be thought that this account centres too greatly on London. This is because the Minister has special responsibilities with regard to traffic in the London traffic area, responsibilities which in the remainder of the country fall on the local authorities. We are increasingly impressed by the flow of information which reaches us from the country as a whole about the increasing tempo of traffic engineering measures. As the pressure of traffic increases upon our towns and cities, the responsible authorities are applying themselves to the problems with which they are faced and are taking the measure of them. I gladly pay tribute to the very striking advances which have been made up and down the country.

Although much progress has recently been made, we are still only at the start of the road. It is essential that traffic engineering and traffic management be rapidly developed in this country. This involves both the existence or creation of the necessary nuclei of expertise; and the supply and training of the necessary number of traffic engineers.

The staff of the Road Research Laboratory have contributed substantially to our knowledge of the subject by their researches. They have also provided a most useful stimulus in organizing courses of instruction in traffic engineering to which senior technical staffs of local authorities are invited. At the same time, many of our higher education establishments include traffic engineering in the engineering courses which they offer. In this respect, the creation in 1959 of a Chair of Highway and Traffic Engineering at Birmingham University was undoubtedly a landmark.

Fig. 4. Grosvenor Square, Mayfair, with parking meters in operation, showing smoother traffic flow and easier access.

There can therefore be no question that we possess in this country the necessary centres of knowledge and experience of traffic engineering. But this knowledge must be disseminated more widely, and its application in all proper cases secured. Apart from the role of our universities and colleges, this throws a responsibility on the professional bodies concerned, on highway authorities and on the Government. The Institution of Highway Engineers has introduced an examination for a diploma in traffic engineering. The Institution of Municipal Engineers has included 'Highway Planning and Traffic Engineering' in their syllabus for the *testamur* examination. The Institution of Civil Engineers has formed a Traffic Engineering Study Group. These developments testify to the real interest being displayed by these bodies.

The position as regards local authorities is better than it was, but there is still much more to be done. The London County Council has set up a traffic engineering branch which is being increased to deal with the expanded road programme. Outside London only 20 out of 62 counties and 14 out of 83 County Boroughs at present employ traffic engineers, although some of the Councils have had traffic engineering sections for many years.

The Ministry has circulated to all highway authorities a memorandum advocating the increased use of traffic engineering techniques and the increased employment of traffic engineers. We are also engaged, in co-operation with the universities and the professional bodies, in assessing the foreseeable demand for traffic engineers in local authority employment against the potential output of the various courses available. We are in touch with all the universities at present offering courses, and we are represented on the Traffic Engineering Group of the Institution of Civil Engineers. A special departmental report will soon be made to the Minister outlining the action which may need to be taken and any additional facilities which may be necessary.

I welcome this opportunity of putting these facts before readers of *Traffic Engineering and Control*. There is no doubt in my mind that this is a most urgent and vital question. The provision of new roads, particularly in urban areas is bound to be a costly and difficult process. We must make sure, therefore, that any investment in them is soundly based. Traffic engineering is the means by which this is achieved. It is no less important to ensure that at all stages the best possible use is made of the roads we already have. For this reason I earnestly advocate a co-operative effort between central and local authorities and the universities and technical colleges in an effort to produce more traffic engineers, and to see that their special techniques are more and more widely applied. We know that there are over nine million vehicles on our roads today. By 1965 there will probably be at least 12 million, and by 1970 something like 15 million. Time is not on our side.

RESOLVING the PEDESTRIAN-VEHICLE CONFLICT

by Richard Edmonds, L.C.C.

Chairman Town Planning Committee 1955-61, *and Chairman of the Roads Committee since January* 1961

Fig. 1. *Jay-Walkers at Piccadilly Circus impeding traffic flow.*

THE general awareness of the crisis which besets our towns and cities, as the tide of motor traffic mounts with each decade of the twentieth century, has been highlighted this spring by the International Symposium arranged at King's College, Newcastle upon Tyne, jointly by the Departments of Civil Engineering, Town and Country Planning, and Architecture. What was particularly impressive about this gathering was the international list of speakers chosen for the occasion, particularly those experts from the United States who could testify to the degree of urban blight that has been created by the failure to tackle, in an adequate manner, the problem of motor traffic in central urban areas; the failure to deal with communications generally in a spirit of reasonableness, bringing to bear on it all the palliatives and restraints necessary for a solution, not to mention all the architectural and engineering ingenuity required by each individual situation.

This may sound like a self satisfied croak from this side of the Atlantic, where we have not yet fully fallen into the mire; but the simple truth is that if all these experts had told the Newcastle Conference all they knew about the crisis in their own cities it would be a formidable tale of woe indeed; but no doubt enough was said about the serious depreciation of American town centres to indicate what may happen here in Britain if we do not heed the warnings of the trouble that is already in our midst.

I am not one of those who believe that an aggressive policy towards the motor vehicle can in any way lead to a true solution. In my view, within the context of this great overall planning and traffic problem, which we all know has many facets, is one factor of supreme importance—the need to provide for the pedestrian in developing and redeveloping our towns and cities with as much vigour and imagination as we provide for the motor vehicle.

The motor vehicle has been with us for over sixty years; a weakly infant, it will be recalled, which suffered from harsh parental treatment, a flourishing youth with ever increasing activity on roads that were built for a horse-drawn age; and now comes ripe maturity with the urban road pattern still hopelessly inadequate to meet the needs of the day. In all this period of massive growth we have failed, with a few notable exceptions, to realize the new situation and the dual nature of the responsibility. We have failed to accept that there must be reasonableness towards the car user and the pedestrian alike, and that they must be kept apart for their own comfort and convenience, for our well-being generally.

Fig. 2. An early stage in the improvement at Elephant and Castle showing the old layout.

Hitherto we have failed to accept the necessity for multi-level solutions.

Why we have failed in this matter it is hard to say; but the truth is that English roads from the seventeenth century to the mid-nineteenth century were hopelessly neglected and ill-provided for, partly perhaps because each parish had to maintain its highways by statute labour and had very little inclination for the task, even when tolls were sanctioned. Subsequent Public Health and Local Government Acts paved the way for a better co-ordinated system, but even after the Road Improvement Funds Act of 1909, establishing the Road Board which was later merged with the Ministry of Transport, there was no real urgency or progressive thinking in these matters. There has been very little since. As one critic of the present pattern said recently, we are kerb conscious, bollard minded and very little else. A harsh comment no doubt, but with an element of truth.

Even in the 40's and 50's of the present century, when the real impact of the motor vehicle on our civilization should have been readily realized, very few new ideas penetrated official thinking on the question of the motorist and the pedestrian. Too often we have been content to put into a road improvement scheme a few judiciously placed subways, and to let the matter rest, content that we have done our best having regard to all the circumstances. Sometimes, because of the enormous property costs involved in land acquisition for subways (with or without ramps) it has been easier and cheaper to leave the problem to traffic lights.

Most of us now know that these are fatal policies leading us inexorably to fatal compromises in the urban road pattern. The matter will not be allowed to rest as it is. Architect and engineer must combine to make use of different levels in ways that are at once useful and attractive, though no doubt costly and maybe not acceptable to the Ministry of Transport and their hopelessly outdated grant formula based on age-old Treasury restrictions. (Everyone in local government knows that if you stray only a yard or two off the beaten track in seeking a bold solution to a traffic and pedestrian problem at a major intersection the requisite grant is likely to be withheld until other counsels prevail).

Even in the United States, where the hard pressed pedestrian has so often received scant consideration, and has indeed become almost a creature of the past in some cities, two-level solutions have been achieved with remarkable success. I would refer in particular to the United Nations buildings on the Manhattan shore of the East River in New York. These buildings stand on a spacious stretch of parkland which is, in fact, a podium above the great traffic artery that runs round the perimeter of Manhattan and links with the twin airports of La Guardia and Idlewild. The traffic segregation here is complete, and the whole aspect of the approach to the United Nations is most restful and in marked contrast to the picture we so often see in New York and its environs, where sometimes indeed there is not even a pavement to sustain the footsteps of the last faltering pedestrian.

Here in Britain we are not without a measure of encouragement. There is the already mentioned Newcastle Symposium; Sir William Holford, as might have been expected, has done some bold thinking in the neighbourhood of Piccadilly; and there is the recently announced design for central Chester put forward by Ian Hart in conjunction with Michael Lyell Associates, the London architects, who have suggested a public market, shopping precinct, offices, theatre and hotel ingeniously grouped near the cathedral and the town hall. Manchester's City Planning Officer, Mr. Rowland Nicholas, is also giving a lead in his own city with plans for high level pedestrian ways.

There is, in fact, every evidence of new thinking in this vitally important field, and perhaps some really imaginative policies will emerge from the Ministry of Transport now that Mr. C. D. Buchanan, has moved from the Ministry of Housing and Local Government to the Ministry of Transport. As yet, however, we have in this country few practical

Fig. 3. The improvement at Elephant and Castle after reconstruction and provision of pedestrian subways.

examples of segregation of traffic and pedestrian actually achieved outside London (Lansbury for instance), Coventry (Hillfields), and the new towns, Crawley, Harlow, Stevenage, and Glasgow's Cumbernauld with its market-place above a car park.

On the drawing board, and also at their initial stage, are one or two particularly progressive plans in the London area, notably in the City of London's Barbican plan, where pedestrian walkways at the 28 ft. level are being incorporated in each building given planning permission along the length of the newly created London Wall. This, indeed, was a major planning triumph for the City, who also made good use of the opportunity to provide extensive public car parking beneath the road surface of this new city by-pass.

Elephant and Castle Improvement

It could also be said that the Elephant and Castle shopping scheme has been another signpost on the way, although there the solution has been one of intense difficulty because of converging traffic from the bridgeheads at this gateway of South London, traffic that cannot be readily diverted. As it is, the pedestrian at the Elephant will shop in comfort in a precinct lying on the flank of the traffic system, connected with the outside world by a network of well planned subways which will link directly with the lower level of the shops. With greater co-operation from London Transport Executive the project could have been improved; for here was an opportunity to link the two underground stations with the shops in a really effective manner. In the event, the achievement is rather half-hearted.

With regard to the subways at the Elephant, they may be orthodox in form but the materials used are gay and interesting, with bright mosaics cleverly placed to catch the eye. One can appreciate that an artist has been at work. There is need for more of this and maybe the time has come to promote a national competition to produce brighter subway designs, for those places where subways are unavoidable, in the absence of bolder plans. Figs. 2 and 3.)

Hyde Park Subways

Subways have also loomed large in the Hyde Park-Marble Arch scheme, sixteen of them in all with a total extent of more than half a mile, and these are, of course, of special importance in that they provide vital links beneath the new traffic area between London and her great park system, unique at once in its central situation and its loveliness.

Now what lies ahead, what scheme will carry this battle for segregation a stage further on its way? In my view it lies in the decision of the London County Council to realign the southern approach to Waterloo Bridge, and the subsequent invitation to Rendel, Palmer and Tritton, the consulting engineers, to produce a report which would allow a complete system of pedestrian circulation in a largely open area lying beneath the traffic roundabout. This report is awaited with the keenest interest at County Hall, for if the terms of reference are fully met it is clear that the pedestrian will be able to approach Waterloo Station in a variety of ways and in freedom and comfort.

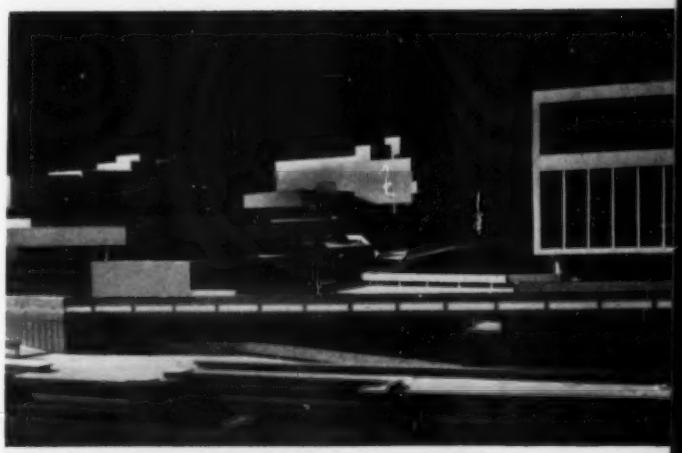

Fig. 4. Model of projected South Bank development with high and low level pedestrian ways and provision for traffic at the intermediate level.

This Waterloo Bridge southern approach scheme indeed represents multi-level circulation at its best; for it will be linked also with the immediately adjoining South Bank developments, where high level walkways at the 28 ft. and 32 ft. levels are being provided to take the pedestrian from Hungerford and Waterloo bridges across to the Royal Festival Hall and the new concert hall and, via the main Shell building, to the concourse of Waterloo Station. Those who are so minded could indeed walk at this level from the platforms of Charing Cross to the platforms of Waterloo. (Fig. 4.)

Riverside Walkways

Here is a high level and low level pedestrian network with the traffic network at the intermediate level, and there is no reason why this should not be extended to the downstream side of Waterloo Bridge (where there will be steady development in the years ahead) and also upstream to the area round the projected new St. Thomas's Hospital. Ultimately, the riverside walkway from Waterloo Bridge to Vauxhall Bridge should be uninterrupted at the Westminster and Lambeth bridgeheads; this creates no great difficulties, and it should have been tackled long ago.

The critics will no doubt say that a multi-level scheme such as that at Waterloo Bridge southern approach is not so difficult to accomplish in an area of large scale redevelopment; but that the real hard core of the problem lies in the more or less settled areas of central London where traffic and shoppers are in daily conflict.

The critics are right; but here too there are grounds for cautious optimism and many people will have been much impressed by the recent paper given at the Royal Institute of British Architects by D. Rigby Childs, A.R.I.B.A., on the subject of 'The Major Shopping Street,' also referred to by Sir William Holford in his article in this issue and illustrated on page 31. Mr. Child's bold endeavour was (and we must admire his courage in the face of a multitude of difficulties above and below ground) to take Oxford Street, the hardest nut of all to crack, with the maximum pressure on land

(*Concluded on page* 32)

A QUESTION OF PRIORITIES

Fig. 1. Looking northwards across the projected pedestrian precinct at St. Paul's, round which an extensive area will be closed to motor vehicles.

by Sir William Holford,
President Royal Institute of British Architects

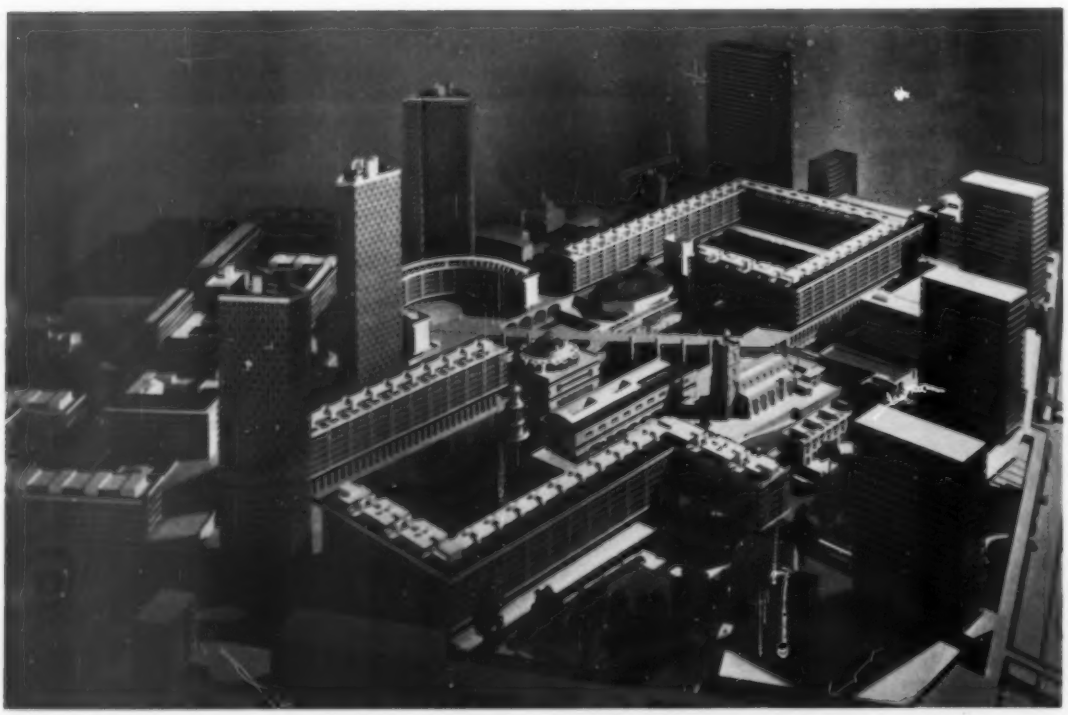

Fig. 2. Model of the Barbican development in London now under construction. When completed, pedestrians will be segregated from motorized traffic on 28 ft. high walkways.

TRAFFIC congestion in towns, coupled with growing demands on road transport by industry, tourists and commuters, is forcing all of us to ask for more and better roads. The Minister of Transport can therefore depend on a constantly increasing volume of support for devoting a larger proportion of the national income to the improvement of communications. During the year since this Journal first appeared, in May 1960, there has also been a clearer realization of the fact that although road-making is primarily a matter of engineering, there are a number of supporting skills and studies which can make the difference between creating a mere artery for traffic and solving a traffic problem. New roads can easily fail to give value for money; worse still they can themselves produce a traffic problem that did not exist before; and if, with these defects, they are also unsightly, or damaging to the landscape, or if they depreciate social, architectural and property values in a town, then the public has a right to ask that road schemes should be looked at from many points of view besides the motorist's, before construction actually begins.

This article is not intended to suggest to those responsible for establishing priorities in this matter what they should do. It is intended simply to advance one or two arguments that have not often been weighed in the balance when priorities have been debated.

Fig. 3. (above). A superimposed drawing illustrating D. Rigby Child's scheme for pedestrian walkways and travelators down the centre of Oxford Street with access to shops and offices at the upper level. (Photograph by Keystone.)

Fig. 4. (below.) illustrates how Oxford Street would appear were the scheme carried out. The street has been widened and parking bays provided by narrowing the pavements which is made possible by the segregation of pedestrians from traffic by diverting them to the upper level walkways. (Photograph by Keystone.)

Outstanding Villages and Town Centres

The first concerns historic values, and is really a question of preservation—quantity versus quality. There are a few villages and small towns of great antiquity and character, whose value resides not in a few outstanding buildings but in the town as a whole, or at least in its old centre. It is the sense of completeness and of historic continuity which makes these places so attractive to tourist, visitor, scholar and resident. Often they lie in the path of a production line, or even across it, as Warwick does in relation to Coventry and Birmingham. Warwick within its gates and walls has good examples of every period of English building and is still a most livable-in place. Yet heavy industrial traffic thunders through High Street and Jury Street making a mockery alike of those who care about preserving the old and those who are trying to make the new good enough to compete with it, and thus maintain a fine tradition.

The obvious by-pass is physically practicable, economically possible and, in fact, already planned in outline. But the population of Warwick is very small, and this particular traffic improvement has to take its slow turn in the queue. This would be perfectly reasonable if traffic planning were a military operation and the weakest were always to go to the wall. The values of Warwick that are so vulnerable are also irreplaceable, and it would be a pity if the traffic diversion that would save the centre of Warwick—and of perhaps half-a-dozen other historic towns similarly situated—were to be delayed until there is little worth saving. They should be entitled to jump the queue.

The Pedestrian

Another and quite different case for priority concerns the pedestrian. He, too, is part of the circulation pattern of a town, even though the definition which is now ironically applied to him is that he is 'a man who has succeeded in parking his car'. Some priority is secured for him by policemen and by zebra crossings, but he is made to feel more and more that he is only allowed on streets and unfenced pavements by sufferance and not by right. Sooner or later he will demand a zone of movement rather greater than the few steps between one traffic intersection and another. Hence the great attraction of an idea put forward recently by an architect and planning consultant, Mr. D. Rigby Childs, and his colleagues, for pedestrian walkways and travelators, a mile and a quarter long, down the more or less level length of Oxford Street. The new structure would run down the centre and be self-supported on pairs of columns about 72 ft. apart. Bridges would connect the elevated pedestrian walkway to existing shops, and the different pedestrian levels would be connected by escalators. There are some traffic problems still to be solved in this project; but the principle behind it, as also behind the development of the St. Paul's Precinct (where construction has just begun), of the new London Wall (originally Route 11) and of the Barbican development in the City of London, and of my own provisional plan for Piccadilly Circus and its immediate surroundings, is the same; namely, to give the pedestrian a circulation level where he is free and uninhibited, interested by what he sees, and no longer a hazard to motorized traffic. Here again, in the most thronged thoroughfares of the big cities, a few executed examples of pedestrian segregation carried out by architects, engineers, surveyors, valuers and traders, planning and working together, might set a new standard for traffic improvement in towns; it is less ambitious but also more economical than the giant urban motorway which, although it may prove to be necessary in the end, may have to wait its turn in the national road programme.

Motorways in the Countryside

The inter-city motorways are a different story. Their worth is being abundantly proved. Their capacity is ahead of demand, unlike most urban improvements which barely keep up with existing congestion. But here too there seems to be a question of priorities. M1, the South Wales Motorway, and some of the spurs feeding into them, are part of the production line and would be industrially justified even if they brought no other traffic benefits with them.

When the obvious needs have been met, it will be interesting to note whether a motorway could be used for development purposes, that is to say to open up an area of potential unemployment, or to strengthen an area suffering from economic depression, such as Merseyside.

On the other hand, when motorways are also scenic routes, as for example the present Ross Spur, running north of Tewkesbury over the Severn to Ross-on-Wye, there does not seem to be much point in demanding the full specification, i.e. three lanes on each of the divided carriageways and unlimited speed. These motorways might well put interest above speed in their design, their construction and their landscaping; and thus start for motorways a sort of classification such as that applied to A and B roads.

There are obvious advantages, once a project is fully planned, in shutting out all external considerations and concentrating on the engineering, the organization and the technique of getting a job through. This reduces construction time, gives a sense of urgency to the work and produces efficient management. But the planning process itself is a time for exposure to ideas and influences; and it is then that collaboration can be most fertile. Much sterile argument revolves round the question as to who should be primarily responsible for construction —engineer, architect, builder, local government officer or consultant. The question whether a landscape architect, a town planner, a sociologist, an economist or an industrial designer can make a small but vital contribution to the preliminary thinking, which should precede any large civil engineering operation, is often not asked; and a suggestion coming from outside is regarded as interference. Yet land use and land economics, social and real estate values, the design of landscape and of utilities, are all contributory factors, if structural forms are to have meaning and purpose. The traffic engineer who is sensitive to the environmental arts and knowledgeable about other technologies than his own, is likely to be a worthier successor to Brunel and Telford than the most dedicated specialist.

Pedestrian-Vehicle Conflict (*Concluded from page 29*)

resources, and to introduce a multi-level circulation scheme as a continuously progressive operation. He declared in his paper that he had in mind the need to find a way by which modernization could spread through the street quickly and without causing disastrous upheaval.

Mr. Childs has tackled the problem by preserving Oxford Street as an east-west traffic artery and planning above it a shoppers' way, a mile long upper deck for pedestrians only, an unbroken street of shop windows, show cases, small shops, and inquiry offices with access by bridges to the first floors of the adjoining shops and offices. Escalators and staircases at various points give access to present pavement level and to underground stations.

The upper pedestrian level will give scope, says Mr. Childs, for fast pedestrian movement by travelators in each direction, with interchange points about every three hundred yards and with points for stepping on and off half way along.

Meanwhile the ground level pavement would be banned to pedestrians as a through walkway, being used for access to vehicles and street level facilities; and at this level there would be laybys for vans, buses and private cars so as not to interfere with the general flow.

While Mr. Childs' £12,000,000 plan for Oxford Street may remain only a highly imaginative dream, and the degree of co-operation it demands is unlikely to be forthcoming, at least he has stimulated thinking on even bolder lines. The riverside redevelopment at Deptford is to be planned on these principles of pedestrian segregation. It is now up to the great army of multi-levelists to carry on the battle.

Case for
URBAN MOTORWAYS

by Wilfrid Andrews

Chairman of the Roads Campaign Council

Fig. 1. Bridgehead at Mannheim, West Germany, comprising five stilted highways and a redeveloped post-war bridge with six traffic lanes, two cycle tracks, a tramway, railway line and footpaths, connecting with Ludwigshafen across the Rhine.

TO BE one of the outspoken voices in urging the authorities in Britain today to build urban motorways is like carrying the Olympic torch. The Roads Campaign Council, together with a handful of respected institutions and individuals, has taken up an appeal from a public, heartily sick of urban congestion but I have grave doubts whether less enlightened authorities, in national and local government circles, are prepared to run the last lap in a race against time and provide the obvious answer to the crisis in our cities. In more caustic moments I am prepared to believe that these authorities are suspicious lest they grasp a nettle instead of a torch.

Primarily one of the fundamental objectives of the Roads Campaign Council in 1961-2 is to press both the London County Council and the Government to plan and build urban motorways in Greater London and the central environs of the Capital. The case in favour of urban motorways is squarely based and unshakeable; the case against them is fragmentary and badly documented because there are more opinions and feelings than facts.

Regarding the official policy, if one were to pay serious attention to the many statements concerning these highways, one would imagine that British cities will not need them until sometime after 1975, rather than today. Birmingham and Leeds, Manchester and Glasgow are among our principal cities which have firm plans and data for urban motorways. London is the orphan city. The authorities have no reasonable, clearly defined plans and very little up-to-date data.

I intend to review the situation in London and compare it with the experience I have gathered in talks with continental city authorities and from viewing their exciting projects. I should like to emphasize that I speak as a reasonably lucid layman, not as any kind of amateur engineer or planner. As a member of

Fig. 2. Grosvenor Place, Central London, blocked by vehicles and pedestrians during the rush hour.

the public I should like to point out that it is for our convenience that projects such as urban motorways. or drainage are constructed. And, since we pay for them, it seems reasonable that we should be the judges of their worth. I feel this point is often overlooked in the rarefied atmosphere of some expert opinion on the subject.

First, there has been a quiet revolution on the continent from which the urban motorway is emerging in a score of large cities. Primarily their *raison d'etre* is economic. Another reason is the urge to maintain civilized and convenient travelling facilities in an age which will be noted for the great explosion of public preference in favour of personal transport.

Fig. 3. Typical morning traffic jam along the Victoria Embankment, London, illustrating the need for urban motorways.

That statement is alone capable of inducing apoplexy in the headquarters of the London Transport Executive and among certain experts. London Transport's policy towards urban motorways was clearly defined at Nice last year when Mr. J. D. C. Churchill, the assistant secretary, said:

> 'It is commonly assumed that the solution of urban traffic congestion problems lies in the construction of urban motorways connecting the city centre with the nation-wide trunk road system. The manifest failure of this policy in the U.S.A. has even been explained away on the ground that insufficient urban motorways have been built'.

Mr. Churchill reasoned that the more urban motorways you build, the greater the traffic you attract into a city. As though that was necessarily an evil thing. Immediately we smell out that old bogy: the 'American cities crushed between the roads.' That argument is as sound as a sinking pontoon. Some allowance must always be made for bold experiment and we should give credit to the planners, architects and engineers of the U.S.A. who had the vision to realize that unless they produced a new formula for their cities they would subside under the avalanche of vehicles, and never fulfil their original purpose of providing a human, commercial, social and cultural centre. Ponder for a moment and imagine the fate of New York, Chicago or San Francisco without the urban motorway. Would they be the flourishing communities they are today? I doubt it. The American experiment may have had rough edges, but the formula appears to be perfectly sound. It becomes the combined and equal responsibility of the planner, architect and engineer to make the formula both efficient and pleasant to the user.

The final demolition charge in the argument can be found in Brussels, West Berlin, Dusseldorf, Stockholm and Vienna. Each of these cities—and there are many more that could be quoted—has had the foresight to send experts to the United States on study tours. They have returned and distilled the American highway know-how into a European blend. The motorways serving Dusseldorf, Rotterdam, Mannheim or Ludwigshafen are tailored to fit European proportions. I suspect that a great deal of bunk is uttered in hallowed circles about 'the precious fabric of London.' Of course it is precious but none of the inhabitants of the Continental cities I have quoted have less regard for their traditional centres of activity. Surely, cities are not meant to be museums to past glories. I am staggered at the colossal impertinence of those who complain of the aesthetic atrocities of urban motorways and are, in effect, accusing the planners and people of Zurich, Stockholm, Stuttgart or Vienna of being unfeeling Phillistines. To me this preaches an absurd principle which led Nero to fiddle while Rome burned.

Examine the fabric of London and you find much that is beautiful and essential to the culture of a capital, but travel out into her northern, southern, eastern and western suburbs and you find acres of dreary, unplanned Victorian horror-building totally unsuitable for contemporary prosperity. This, too, is part of the 'fabric of London' and I say it would be a mercy to redevelop, with planned motorway building relieving in a balanced and integrated style, those areas where true beauty walks.

I have great confidence in the capabilities of our

planners, architects and engineers. In 1959 the Roads Campaign Council sponsored an international competition, 'New Ways for London.' We attracted entries from all professions concerned with the problem. At the end of the competition the prize winners produced a joint statement. This is what they said:

> 'London has no traffic plans. The L.C.C. Development Plan is obsolete and based on the academic Abercrombie Plan of 1944 when so little was known about motor traffic . . . . This situation, if continued may have disastrous economic consequences'.

These men were not just interested professional passers-by drawn into the competition by the opportunity of substantial prize money for a few outlandish Utopian sketches. Each spent more than a year studying every intimate detail of the problem and the quality of the assessors was beyond approach. One of the points of their statement was the need for surveys to establish up-to-date data of the traffic trend and I am delighted to see the L.C.C. and Ministry of Transport combining to sponsor such a survey. If this portends original thought in high places for an urban motorway, it will be greeted by wild applause by the millions using London's roads.

Some will quote the advantage of building extensions to the London Underground railway system. And, provided this is not advanced as a reason *not* to build urban motorways, it has my support. Although, we cannot lose sight of the fact that the proposed Victoria-Walthamstow tube would cost an estimated £55 million and never pay for itself in economic returns. It may sound very final to say that an equivalent motorway to the tube would need 14 traffic lanes, but if this is true, that would be a motorway divorced from an integrated pattern of such roads which would counter-balance the weight of traffic.

Motorways in London have been estimated to cost £6 million per mile. Although that may be 20 per cent more than a mile of tube railway, it does pay for itself at an estimated return of 5 per cent per annum; it does offer 24-hour amenity to the public and it does have a dual purpose in carrying industrial goods. Brussels is the living proof of this, where, according to a recent report, their new road system will have returned such economies that, and I quote the Belgium Minister of Public Works, Mr. Omer Vanaudenhove: 'Brussels' road programme will be entirely paid off by 1962.' That is four years after the programme was completed.

When one reviews the need for urban motorways, especially in London, one cannot fail to be impressed by the quality and amount of thought that has gone, unofficially, into the problem. I know of at least seven planned motorway systems including the one produced in 1959 by the Association of Metropolitan Borough Engineers and Surveyors, men who live with London's traffic problem for 16 hours a day.

At present we have a £200 million roads plan for London which the L.C.C. is beginning to programme. This is the second of the two optional road programmes for London produced by the Nugent Committee in 1959. The brief handed to this Committee before it began its deliberations was this, in effect: 'Produce a plan suitable for traffic in London by 1980.' They said this about urban motorways:

Fig. 4. Urban motorway, Milan, showing the semi-cloverleaf connecting the southern suburbs with the Autostrada del Sole.

> 'Such ideas may well have a place in London in the future. It has not been possible for us to reach any conclusions in this report on the merits of any of these projects and, in any event, their construction is not feasible within the foreseeable financial limits . . . '.

The Committee sat for 18 months. They were planning for the benefit of the next generation. Compare this kind of defeatist thinking with the plans for Stockholm, a city one-tenth of the size of London. By 1980 Stockholm will have 72 miles of urban motorways plus integrated parking schemes for one-fifth of the city's total car population by that time and planned compatible extensions to their tube railway system. This is expected to cost nearly £173 million, or approximately £8 per head of the population per annum.

London, in 1961, has just been authorized to spend up to £10 million by the Minister of Transport. Taking the Greater London population, that is a little over £1 per head per year. This highlights another skeleton in the cupboard in the consideration of

Fig. 5. Bayshore Freeway, San Francisco, a typical American urban motorway.

London's apathy towards urban motorways—money. The critics point to the tremendous cost, while adroitly turning their backs on the rising tide of traffic, and claim London could not afford these highways.

I am advised an urban motorway for London would be earmarked as a Class I road and entitled to a 75 per cent grant for construction and maintenance by the Ministry of Transport. Therefore, if it cost £500 million to build these roads over 10 years the local authorities would need to find only £12.5 million a year, and that is probably a wild over-estimation by a layman of the original cost. Is that too much to pay for mid-twentieth century road communications? The cost of traffic congestion in London totals at least £30 million per annum. The next point to remember is that about one-fifth of the total population of Great Britain would benefit from such a road system.

So far I have dealt with the need for these roads, and I am conscious that I am preaching to the converted in the readership of this magazine. But facts show the real economic advantages of building an urban motorway similar to the 5½ miles that West Berlin has just completed. One never gets far with this argument until someone points a wavering finger at the 'dreadful tide of vehicles that will invade London if you give them better roads.' Analysing that statement one is smitten with the distinct feeling that it is absurd. It is absurd, I submit, because the greater the traffic the greater the profit, both to the user, and the commercial community. The same case stands vice-versa if the roads are not built.

That erudite Scot, Professor W. Fisher Cassie, of Durham University, recently addressed the All-Party Roads Study Group in the House of Commons, and his paper was published in the February issue of this Journal. He reported this pearl of wisdom to the protagonists of urban motorways:

> 'If one-fifth of the total mileage of a community's roads is an urban motorway, it can carry 50 per cent of the total traffic.'

Yet in the case of London, if we assume 50 per cent of the traffic is on an urban motorway it has at least been funnelled off safely and efficiently from the six national motorways which are to arrive in London. The closer the traffic comes to the heart of the city the greater the problem of dispersal and cohesive movement. This is where the planners, architects and engineers must provide an answer that is both gladdening to the eye and practical. I cannot believe that this is an insupperable problem because a feature of Rotterdam, Cologne and Stockholm is the integrated planning of pedestrian and vehicle movement so that neither is a menace to the other.

A great deal has been said recently of an eminently sensible, if limited, plan to construct roads over railways or on stilts along existing highways. In 1960 I saw the work carried out in Mannheim, where five overhead structures fed traffic to a new Rhine bridge. At one spot an overhead road followed a graceful arc along the boundaries of a public park. Sitting almost under the shadow of the trees that bordered the road were old men dozing on park benches and babies asleep in their prams. Although the road was heavily trafficked it was unobtrusive. For evidence of the noise factor I can report that the rest of neither young nor old was disturbed.

What is disturbing when one views the tremendous road expansion on the Continent, with all its verve and vision, is the economic threat that this will present to British commerce and industry when its full effects are exploited. It has been authoritively stated that ten per cent of all our transport costs are lost in congestion. Since a great deal of this congestion occurs in urban areas it is frightening to read Road Research Laboratory reports warning that unless drastic steps in the other direction are taken at once, by 1967 the congestion bill could total £2,000 million. That is four times my pessimistic and inexpert valuation of the cost of an urban motorway for London spread over ten years. Faced with such statistics, it is little wonder that five of our main Continental competitors—West Germany, France, Italy, Holland and Belgium—have 15 and 20-year road programmes well primed with urban and national motorways.

In the six large conurbations of Britain 37 per cent of the population live in a mere 4 per cent of the land space. Since the ratio of cars to people is fairly equally divided at approximately one to seven in town and country, the priority that can be deduced from this for full-scale mobilization of our road-building resources on the urban problems is easily seen. The registration of vehicles over the past five years has staggered official note takers yet the warnings have been plain to see in repeated reports from the Road Research Laboratory. The Minister of Transport has recently announced that he intends to authorize increased expenditure on classified road schemes to £100 million between 1961-2 and 1963-4. I can see little relation between this substantial, but insufficient, sum with a vehicle population that has increased by 50 per cent in the past five years and shows every inclination to continue rising.

There is little wonder that the public desire for personal transport should be so great. At the last General Election there were renewed Government promises of more leisure, a doubled standard of living and a car for every family. While this means that the motor taxation receipts, already £600 million, will continue booming, it is little more than primary common sense that the expenditure on providing the facilities for movement should at least keep step with the geese that are laying the golden eggs.

It is not possible to progress very far with the urban motorway question before the equal and kindred question of parking is arrived at. The parked car cannot be divorced from road improvements and should have off-street facilities geared to the user's pocket in order to attract him off the streets.

The parking meter, alone, is neither an answer nor fair. The off-street garage, planned and part of the overall road plan, was always present when I saw the plans of Brussels, Berlin, Stockholm, Cologne or Rotterdam. Clearly, the traffic engineer, will not tolerate all-day parking on busy streets. I am told that the average speed in London is less than 10 miles per hour. While one can travel through many large Continental cities at 20 m.p.h. the threat to our economy and the humiliation of the Londoner are in themselves sufficiently strong reasons to justify immediate action to build in London an urban motorway.

European Report

PLANNING MUNICH'S TRANSPORT

Fig. 1. Section of the Oskar von Miller Ring Road, Munich.

Professor Dr.-Ing.habil. K. Leibbrand
Translated by Nigel Seymer, M.A.

Translator's Note

It is now over six years since the late Professor Feuchtinger and Professor Schlums completed their celebrated study of road traffic in the Munich area. Their report, 'A Traffic Study Concerning the Arterial Road System in the Munich Area', was presented at the 1954 *International Study Week in Traffic Engineering. It recommended that the three motorways which converge on Munich should be linked by a star-shaped pattern of urban motorways passing quite close to the centre of the city, rather than by an outer ring motorway as had previously been proposed, or by a system of improved city streets. The city authorities rejected this and adopted instead a proposal for an intermediate ring road at a radius of three to four kilometres from the city centre, to include sections of existing roads, and this was included in the Road Plan adopted by the City Council on July* 2, 1958.

In the summer of 1959, *Professor Leibbrand and two architects, Professors Steiner and Guther, were commissioned to criticize this road plan and the city's master plan. The following is an abbreviated version of that section of Professor Leibbrand's report which deals with transport planning. Professors Leibbrand and Guther have been commissioned to prepare a completely new master plan and master transportation plan for the city, which will take them about three years.*

Prof. Leibbrand's Report

Transport has a decisive influence on the life and growth of cities. That is why cities rightly strive to obtain the best possible transport facilities by land, water and air. Munich, too, must concern itself with this if it wants to retain and strengthen its economic power, and effort must be directed simultaneously towards the improvement of internal and external communications. It is futile to wrangle over the relative importance of long-distance and local traffic because the city needs both. There is, moreover, no sharp dividing line between the two types of traffic.

Transport affects the development of the city as a whole; but it also shapes particular parts of it. Thus the main railway station has, in the course of decades, pushed the commercial centre of gravity of the city further and further west. This single example proves that it is impossible to separate transport and town planning. A new railway station, or a bus stop, attracts development; new building developments call for the creation of new transport links. The interdependence is so close that it is impossible to solve the transport problems of large cities unless there is a clear town planning policy. Three alternative policies are:

(1) Making the traffic fit the cities in their present form by thorough-going restrictions on traffic.
(2) Making the city fit the traffic by turning Munich into a 'pure traffic city'.
(3) Creating an equilibrium between traffic and city.

The Traffic Starved City

Certainly the simplest course is to do nothing at all, then the city saves much money in the short run. More and more prohibition signs are erected prohibiting loading, waiting, parking and driving. Traffic would then eventually come to a standstill. Every employed person, and every visitor to the city centre, would lose more and more time. Movement through the city would become more and more costly for all means of transport. In the end, businesses would move out to places where traffic conditions are more tolerable. For the city there would be economic losses.

Numerous American cities have already had the experience of traffic coming to a standstill owing to the overloading of the streets in the central business district, and the resulting emigration of businesses led to serious losses. This experience teaches that large expenditure for the improvement of traffic in central areas is worthwhile on economic grounds alone. It is especially justified in a city with the cultural and historical importance of Munich. Doing nothing would yield bitter fruits. Thus the view that traffic must make do for ever with the present facilities must be decisively opposed. It would be still more dangerous if far reaching traffic restrictions were to be introduced. If the Old Town of Munich is not to collapse, the inhabitants must be able to provision their houses; and the businessmen must be able to use modern equipment in their firms. This requires deliveries and goods vehicles. Widespread traffic prohibitions would, within a short period, drive out businesses and lead to the growth of depressed areas within the central area.

Traffic planning must not lead to an economic weakening of the city. Traffic prohibitions can only be an emergency measure. Here it may be remarked that restrictions on goods traffic are much more dangerous than restrictions on car traffic. Even the Old Town must be maintained as a living body. Traffic is the blood which flows in its veins. That is no mere slogan. We cannot dispense with traffic, which is a necessary evil. Thus, any solution entailing far-reaching, penetrating traffic restrictions must be rejected, but this does not mean that particular areas should not be reserved for pedestrians.

The Pure Traffic City

The opposite solution would be to make available to traffic all the space which it needs. Existing streets would have to be widened and new streets cut through on a large scale. In Munich, the business area coincides largely with the Old Town; and the business area is the 'hot spot' in city traffic, in which the space needs are greatest. To create the necessary

Fig. 2. Munich's road plan with ring roads and autobahnen marked in red. The broken lines indicate projected construction.

space for traffic, it would be necessary to destroy historical buildings which up to now have given the city its character. Planning must leave untouched those buildings of worth which are still standing.

Equilibrium between Traffic and Buildings

Both of the solutions described above must be rejected. Recognizing that a servicable solution must preserve a sensible balance between the various desires of the city as a whole, this report proposes what is admittedly a compromise solution. It must take account of the justifiable demands for the preservation of the face of the city as we have inherited it, on the one hand, and on the other hand, the genuine requirements of the people who earn their daily bread in the city and are therefore dependent on transport. Certain rules and restrictions are unavoidable. The aim of the improvements, which are recognized as being necessary, is to keep the Old Town and the other parts of Munich healthy and capable of living by their own strength.

An ideal solution can never be achieved. The city is a living organism. The needs of its inhabitants alter. Planning can only be for a limited period ahead. There is partial opposition between the claims, especially as regards economic justification, of the different means of transport, of above-ground and underground construction, which must be resolved by finding a sensible equilibrium.

Overall Planning

If traffic service is to be improved there must be a comprehensive programme, for the difficulties do not exist merely at particular points in the city. The entire transport system, the road network and the public transport network, must be co-ordinated as one system. Here we are concerned first and foremost with passenger traffic, which, in urban areas, creates far heavier demands in terms of space and time than goods traffic.

No transport network can carry more traffic than its weakest limb. The capacity of all parts of the network must be evaluated. With railways this means that free stretches of line, stations, sidings, etc. must be able to handle the same number of trains. With roads it means that free stretches, intersections and parking areas must be given the same capacity. The best motorway is useless if there is no parking space at the destination. Moreover, the inner urban public transport network uses to a great extent the same surface areas as motor traffic. For

(*Concluded on page* 42)

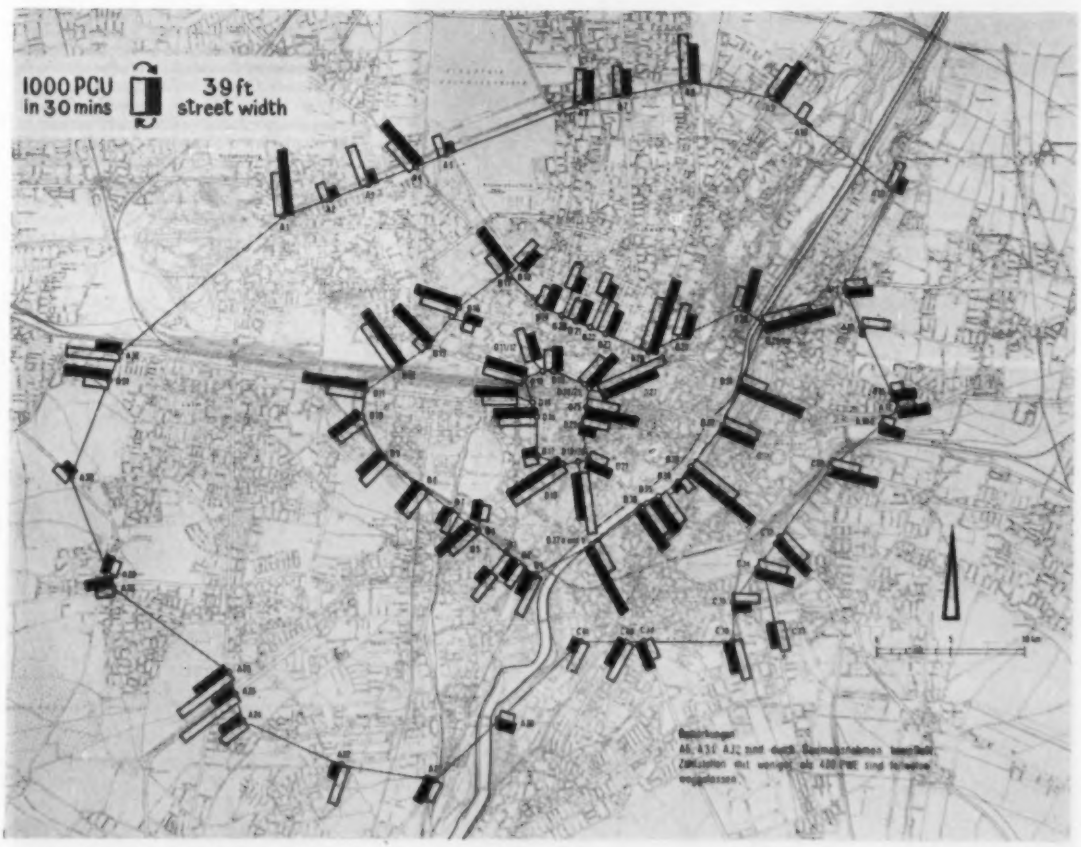

Fig. 3. Diagram of street widths and traffic volumes at census points on the outer, intermediate and inner rings. Streets for which the columns are of equal height (black for traffic volume, white for street capacity) are reckoned to be working to capacity (estimated at 1,000 p.c.u. a half-hour), while those for which the black column is higher are reckoned overloaded during the evening peak hour.

DEVELOPMENTS ILLUSTRATED

Photograph by Taylor Woodrow Group

Photograph by Taylor Woodrow Group

Above. *A view of the multi-storey car park, Zidpark, recently opened in Upper Thames Street, London, with space for 540 cars.* **Left.** *The mechanical system employed in this garage parks the cars by sliding them sideways on rollers, which are shown in detail. The bridge shown in the picture* **Below** *is The Narrows Bridge at Perth, in Western Australia. Of five span prestressed concrete construction, it carries dual three-lane carriageways across the Swan River. It is 1,100 ft. between abutments. Consulting engineers were G. Maunsell & Partners.*

Above. *This four level interchange is the junction of Clearview Expressway and Grand Central Parkway, New York State. This multi-level interchange was designed by Blauvelt Engineering Co. to make use of the existing difference in elevation between the two roads.* **Right.** *A view of Peel Green Junction on the new Stretford-Eccles By-Pass, which forms part of the Manchester Outer Ring Road.* **Below.** *The old swing bridge across the Manchester Ship Canal has been replaced to carry the Stretford-Eccles By-Pass by this new Barton High Level Bridge.*

Photograph by John Dyson, Eccles

Photograph by John Dyson, Eccles

Munich's Transport (*Concluded from page* 39)

this reason, the entire transport system of the Munich region must be treated as a unit. The public transport networks are admittedly subordinate to different authorities, but, in the last analysis, they must all fulfil the wishes of the same employer: the total population of the Munich region.

Permanent co-operation is to be recommended between the authorities concerned with transport facilities in the city and in the outer economic region. The wishes of the various carriers—urban public transport undertakings, other bus lines, railways, airlines and private transport—and the various authorities must be reconciled. A comprehensive approach can be achieved through a high-level standing advisory committee. Well known European examples of such a committee are the Greater Stockholm Transport Committee and the Copenhagen Committee for the Traffic Planning of the Metropolis. The Stockholm committee consists of four representatives of the city, including the Director of Trams and Underground Railways, four representatives of the suburbs, two representatives of the State Railway and two representatives of private transport firms. They report directly to the Ministry of Transport and deal only with questions of suburban traffic. Reference may also be made to the Vienna Road Traffic Enquiry of 1955. Other examples are mentioned in the American publication 'Traffic Engineering Functions and Administration' (1949).

Economic Justifications

The creation of efficient and safe traffic conditions is an important task for the authorities, the importance of which is constantly increasing. All departments must co-operate to achieve this goal. Structural measures are, it is true, very effective, but they require both time and money for their realization. For this reason they cannot be put forward as a first priority and by themselves. The effects of general and organizational measures must not be underestimated.

Improvements in the transport system hardly yield an immediate return. But an economic utility is indubitably present even if its exact magnitude is difficult to determine. Calculation of road costs is one of the most controversial fields of economics. Yet traffic measures must be considered from the economic point of view. Traffic planning must be on a big scale. The technical designs must be so far-sighted that they will not be overtaken by a big growth in traffic. It is precisely for economic reasons that every large expenditure must be based on an exact traffic engineering study. By the evaluation of traffic counts, and by the calculation of capacity, the expected benefit can be determined.

The whole road network, and the public transport network, must be probed in order to determine what increases in capacity are still possible by means of operational changes, including above all:

Segregation of public and private transport.
Segregation of through and terminating traffic.
Segregation of fast and slow traffic.
Segregation of moving and stationary traffic (parking facilities).
Segregation of flows in opposite directions (one-way streets).
Introduction of prohibitions on parking, loading and waiting.
Installation and improvement of traffic signals.
Introduction of green waves.
Interplay of public and private transport, e.g. delivery to parking garages.

Public and Private Transport

Traffic congestion is due simply to a shortage of surface area. If the available space is simply insufficient for all means of transport, then preference must be given to those vehicles which make the most efficient use of the available space, that is those which achieve the highest carrying capacity per square metre. When someone deserts the bus for his own car, for instance, he requires six times as much road space, even without parking space.

The urban traffic authorities must, therefore, favour public transport if they are to prevent a worsening of traffic congestion. This principle was among the recommendations of the International Roads Congress at Istanbul in 1955. The same policy is found in all planning in foreign cities. In spite of, or because of, the great growth in motor traffic in the U.S.A., authoritative planners there recommend the same principle. A good public transport system will halt the diversion from public to private transport, and postpone for years the need for new streets or the widening of existing ones, the installation of traffic signals and the provision of parking space. Public transport must be fast, cheap and comfortable.

Land Use Planning

Planning dictates the location and size of settlements which will become the origins and destinations of new streams of traffic. Settlements of more than 10,000 inhabitants need a rail connection, especially for their goods traffic. The building of new lines is ruled out, though the opening of new railway stations may be considered. Large settlements should, therefore, always be located somewhere where there is an existing railway line.

New outer settlements for the inhabitants of a big city should be only a 45-minute journey from the city centre. This journey time must include the trip by public transport, time spent waiting and on interchange, and time spent walking to the station. In exceptional cases, a car journey time of 45 minutes may be taken as the yardstick. The 45-minute time zone can be enlarged by speeding up public transport services. Good timetables for suburban trains and express bus lines are very important for the growth of a city region. New towns outside the 45-minute zone are not healthy from the transport point of view, especially if they are purely residential or dormitory towns. When new factories are being built or old ones extended, dwellings for staff and workers should be provided close by. However, changes of job and the presence of several employed persons in the same household together with school children and apprentices lead always to journeys over longer distances than a man can walk.

AMERICAN REPORT

'Revised Manual on Traffic Control Devices'

by Burton W. Marsh & William L. Carson

is held over until next month.

Traffic Problems in Towns

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On February 6, Dr. Smeed presented a paper to the Manchester Statistical Society on 'The Traffic Problem in Towns', some extracts from which are reproduced below, preceded by the introductory summary.

Summary

(1) The percentage of people living in urban areas is increasing in all countries for which information is available.

(2) In Great Britain, one-third of the mileage of roads with side development for shops, garages, factories, etc., occurs in areas officially classified as rural.

(3) The number of motor vehicles per head of population is increasing in every country for which information is easily available. The minimum rate of increase is 3.7 per cent per annum in the United States, the maximum 27 per cent per annum in Spain where there are only 0.024 motor vehicles per head of population.

(4) Comprehensive studies of journey speed are only available for a few towns. The mean journey speed in the centres of some of these towns during normal working hours is between 8 and 10 mile/h. and is decreasing. The rate of decrease in London is 1.9 per cent per annum. This is associated with an increase in the amount of traffic of 2 per cent per annum. This may be compared with a rate of increase of 8.7 per cent per annum in the traffic in Great Britain as a whole. There are indications that the percentage rate of decrease of journey speed is greatest on roads where the journey speed is lowest.

(5) The distribution of speeds of journeys made at different times during normal working hours on the same stretch of road is usually approximately 'normal'. The standard deviation of these speeds decreases as the mean speed decreases but the co-efficient of variation increases. For roads with a given mean speed, the standard deviations of speed are about the same in London and Glasgow.

(6) The range of times taken for a journey on a given stretch of road during working hours increases markedly as the mean vehicle speed decreases. Thus, on a road with a mean speed of 18 mile/h., 20 per cent of the journeys of one mile in length take times outside the range 2.9 to 4.1 minutes. On roads on which the average speed is 4 mile/h., 20 per cent of the journeys one mile in length take times outside the range 10 to 32 minutes.

(7) The number of journeys by public transport in urban areas is decreasing. Between 1950 and 1958, the rate of decrease in the U.S.A. has been 7 per cent per year. During the same period in Britain, the rate of decrease has been 3.6 per cent per annum in London and 2.3 per cent per annum outside London. In Detroit, U.S.A., a city which has an especially low density of population, the rate of decrease between 1945 and 1959 was 8.2 per cent per year.

(8) Every vehicle using the road system has a tendency to cause delay to other vehicles. Whilst these time losses are often small, they are appreciable under quite commonly occurring conditions. An extra car travelling for one mile on a road where the average speed is 5 mile/h. causes a total loss of 0.56 vehicle hours to other vehicles. An extra bus causes time losses of about three times this figure.

(9) Despite the considerable time losses that a journey by car imposes on other persons, the time gained by a motorist by using his car may, in some circumstances, outweigh the time losses he imposes on others. Even when it does not do so, the economic value of the time gained may be greater than the economic losses imposed on others.

(10) Large delays can sometimes be caused by parked vehicles. For example, if 1,000 cars arrive per hour on an arm of an intersection, through which the signals permit vehicles to pass for 50 per cent of the time and a car parks for 10 minutes 25 ft. away from the intersection, it causes time losses to other vehicles of about 10 minutes if the approach width is 24 ft., 80 minutes if it is 20 ft. and 290 minutes if the approach width is 16 ft. If the parked vehicle stays for 30 minutes instead of 10, the time loss on the widest road is trebled but time loss on the narrowest one is multiplied by nine. Since many intersections in urban areas are nearly saturated with traffic, conditions under which parking can cause large time losses to other vehicles occur frequently.

(11) A journey of given length during the peak period may be regarded as requiring an area of ground space. A journey by one person of one mile requires about 1 square ft. by urban or suburban railway, 3 square ft. by walking, between 5 and 21 square ft. by car according to the number of persons in the car on an urban motorway. If the journey is made by bus, it usually requires 4-7 square

ft. per person. If it is made by car on an ordinary city street, it requires 10 to 80 square ft., depending on the nature of the road and the number of occupants of the car.

(12) In order to throw light on the ground space requirements of a town for the journey to work, a theoretical model of a town has been considered. It is supposed that, except in the area required for roads, the places at which people work are uniformly distributed over a circular central area and that their homes are uniformly distributed in a circle outside the central area. It is found that:

(i) The road space required per person using the central area increases with the size of the town. If the private car is used for travel, the area required per person for roads and parking in the central area increases especially rapidly. In the cases considered, when the number of persons travelling in the central area increased one hundred-fold from 10,000 to 1 million, the area required for carriageway space increased more than one thousand-fold.

(ii) If travel is by private car, the amount of space required for parking is greater than that for carriageway space in the smaller towns but less than that required for carriageway space in the larger towns. The use of multi-storey car parks considerably reduces the need for carriageway space as well as parking space.

(iii) Towards the centre of a town equal amounts of radial and tangential road space are required. At the outskirts of the central area the space required for radial roads is 60 per cent higher than for tangential ones.

(iv) The overall radius of the town depends almost entirely on the numbers of inhabitants and the density of population in the residential area. Neither the density of workers in the central area, nor the requirements for carriageway space affect the overall area greatly.

Dr. Smeed then dealt with the increasing urbanization of the world's population, and in regard to Great Britain, stated:

Urbanization of Great Britain

The smallest increase shown in the rate of urbanization is that for Great Britain, but this is probably largely due to the fact that the definition used for urban areas in Great Britain is that used for local government purposes. That this is, from some points of view, not a satisfactory definition is illustrated by some of the results of an investigation made by the Road Research Laboratory. 1,111 points were chosen on a representative—random—basis on the roads of Great Britain, (25,000 miles of the least important rural roads excluded) and the characteristics of the road system at these points were found. The results, as far as the nature of roadside development is concerned, are given in Tables 1 and 2 above, a road being classified as built up at a point if there were several houses or other buildings within 50 yards of the point.

TABLE I
Type of Road

	Urban	*Rural*	*Total*
Mileage of roads with buildings ...	38,400	15,900	54,300
Mileage of roads without buildings	17,900	90,300	108,300
Total	56,300	106,300	162,600

TABLE II
Type of Development

Type of buildings	*Urban*	*Rural*	*Total*
Residential	34,700	14,500	49,200
Shops, garages, factories	2,500	1,400	3,900
Offices, public buildings	1,200	100	1,300
Total	38,300	15,900	54,300

It will be seen that 29 per cent of the mileage of built-up roads occur in rural areas, that 15 per cent of the mileage of so-called rural roads examined has buildings by the roadside, that almost all office and public buildings occur in urban areas but that 29 per cent of mileage of roads with side development for residential purposes, and 36 per cent for shops, garages, factories, etc., occur in rural areas.

The paper proceeded with data on the increasing motorization of the world's population, and continued:

For every country for which information is available, the number of motor vehicles per head of population is increasing. The minimum rate of increase is 3.7 per cent per annum in the United States, a country which already has 0.40 vehicles per head of population. The maximum rate of increase of 27.4 per cent per annum has occurred in Spain where there are only 0.024 vehicles per head of population. The median rate of increase is 9.6 per cent per annum. As is to be expected, there is a tendency for the rate of increase of motorization to be greater in countries where the vehicles per head is lowest but there are clearly other factors operating also. These rates of increase are high. Together with the rapid increase in urbanization, it would not be suprising to expect increasing congestion in towns.

Consideration was next given to the speed of traffic in town centres; the variability of the speed of traffic on the same road; the variability of journey times on a given road, and the decreasing use of public transport. These sections are given in full:

Speed of Traffic in Town Centres

Although it is known that the speed of traffic in town centres is generally low, comprehensive studies of journey speeds are only available for a few towns. Measurements of journey speeds in normal working hours in Central Glasgow, Central Newcastle and Slough have shown mean journey speeds of between 8 and 10 mile/h. In Central London the mean journey speed in 1960 was found to be 10 mile/h in normal working hours and 8.6 mile/h from 5-6 p.m., when large numbers of people working in Central London start to return to their homes. For a journey of any length, these speeds would—by most people—be regarded as slow, but they are decreasing. Table 3 on facing page gives the results of measurements of mean journey speed in Central London, Central Glasgow and Central Edinburgh at corresponding times of the day and periods of the year for several different years.

The table shows that in Central London, Central Glasgow and Central Edinburgh, mean journey speeds have decreased recently and that in each case the decrease in speed has been associated with an increase in the numbers of vehicles using the roads. This is in contradistinction to tendencies in rural areas where traffic interference is not great. In such places, mean speeds are increasing at a rate of about one mile per hour per year, presumably due to the increase in the proportion of new and high performance vehicles using the roads. In urban areas this greater potentiality for speed cannot be used. Since it is known that increase of traffic on a road is generally associated with a decrease of mean speed, (see below), it is to be presumed that the decrease in journey speed in the town is largely or entirely due to the increase in traffic.

TABLE III

Trends in Journey Speeds and Flows in Central City Areas

City	*Time*	*Year*	*Mean journey speed (mile/h)*	*Mean flow (vehicles/h)*
London ...	9.30—4.30	1954	11.2	1,460
London ...	9.30—4.30	1956	10.7	1,475
London ...	9.30—4.30	1958	10.3	1,585
London ...	9.30—4.30	1960	10.0	1,635
Glasgow ...	9.30—4.30	1956	8.2	875
Glasgow ...	9.30—4.30	1958	8.1	910
Edinburgh ...	9.30—4.30	1957	13.8	915
Edinburgh ...	9.30—4.30	1959	13.1	1,070

The data show that the mean journey speed in Central London has been decreasing fairly steadily at 1.9 per cent per year (the speeds in 1956 and 1958 would have been 10.8 mile/h and 10.4 mile/h respectively if speeds had been decreasing at exactly this rate between their 1954 and 1960 values) whilst the number of vehicles using the roads has been increasing at an average rate of 1.95 per cent per year. This may be compared with a rate of increase of 8.7 per cent per year.

In order to find out whether the speed of traffic has been falling equally on all roads, the roads in which observations of journey speed are available have been divided into three classes, those in which the speed of traffic was lowest in 1954, those in which the speed was in the middle range in 1954 and those in which the speed was highest in 1954. The mean speed of traffic, on each of these three sets of road, was found for each year for which measurements were available. The results are given in Table 4 below.

Over the whole period, on the roads which had the lowest speeds in 1954 the mean speed fell by 0.8 mile/h. On roads of the medium speed range in 1954 the mean speed fell by 1.8 mile/h and on roads where the speeds were highest in 1954, the mean speed fell by 1.9 mile/h. The percentage changes were 1.8, 1.6 and 2.1 per cent per year, respectively.

The data have also been analysed in another way, taking those roads which had the lowest, medium and highest speed range in each survey. The results are given in Table 5 below.

Over the period under consideration speeds on roads in the lowest speed range have fallen by 18 per cent over a six-year period, i.e. by 3.3 per cent per annum, speeds in the medium speed range have fallen by 13 per cent, i.e. by 2.3 per cent per annum, and speeds in the highest speed range by 11 per cent or 1.9 per cent per annum.

As already noted, speeds in some urban centres are low and are decreasing. It is sometimes suggested that they will get lower and lower until traffic stops altogether. This does happen for short periods but it is hardly conceivable that people will—day after day—drive into a town centre and then stay at rest on the roads for some hours. It is much more likely that they will either use alternative means of transport or go somewhere else. However, the results of the above analyses of trends in journey speeds are disturbing and it is worth while examining the data in rather more detail. The variability of times taken for journeys over the same stretch of road will therefore be examined.

Speed Variability on Same Road

The data on the speed of traffic given in Tables 3, 4 and 5 above were obtained by timing a number of test journeys made over a period of two to three weeks on a sample of roads in the towns concerned. Only mean speeds are given above. Cumulative distribution of speeds of individual journeys made in London and Glasgow are given in Figs. 1 and 2. The separate sets of points relate to journeys on different stretches of road, each being about one mile in length. In the diagrams, the vertical scales are so arranged that the cumulative curves would be straight lines if the distributions were 'normal'. (see Figs. 1 and 2 on next page).

It will be seen that most of the sets of journey speeds are distributed approximately normally. The means and standard deviations of the distributions of speeds on the selection of roads shown in the figures are given in Table 6 on next page.

The data suggest that, as the mean speed decreases, the standard deviation of the journey speed has a tendency to fall slightly and that the coefficient of variation has a tendency to increase. It is noticeable that the standard deviation for a given mean speed tends to be about the same in London and Glasgow.

Variability of Journey Times

The assumption that the journey speeds are distributed approximately normally and that the standard deviation of journey speed is related to the mean speed approximately as in Table 6, makes it possible to calculate easily the distribution of journey times. Calculations made in this way of the percentage of journey times less than various values for roads on which mean speeds are 4, 6, 8, 10, 12, 14, 16 and 18 mile/h are given in Fig. 1. For comparison, some actual distributions of journey times are given in Fig. 2.

The data in the figures show that on roads with a high mean speed, journey times vary little from journey to journey but on roads with a low mean speed journey times are very variable. Thus, on a road with a mean speed of 18 mile/h, only 20 per cent of the journeys of one mile in length would lie outside the range 2.9 to 4.1 minutes. At an average speed of 6 mile/h, 20 per cent of such journeys would lie outside the range 7.3 to 16.5 minutes. At an average speed of 4 mile/h, 20 per cent of such journeys would lie outside the range 9.9 to 31.7 minutes.

The fact that the variability of journey time is great when the mean speed is low must—in practice—mean that the effective time for making journeys must be greater than the actual time, because road users often make a journey to a place which they wish to reach by a given time, and must allow for the possibility of their journey taking longer than the average time even when it actually may take less.

Decreasing Use of Public Transport

The increase in the numbers of registered motor vehicles in the various

TABLE IV

Trends in Journey Speeds on Roads in Different Speed Ranges 1954

	1954	1956	1958	1960
Roads in lowest speed range in 1954 ...	7.9	7.7	7.4	7.1
Roads in medium speed range in 1954 ...	11.0	10.5	10.0	9.2
Roads in highest speed range in 1954 ...	16.3	15.9	15.2	14.4

TABLE V

Trends in Journey Speeds on Roads in Different Speed Ranges in each Survey

	1954	1956	1958	1960
Roads in lowest (¼) speed range	7.9	7.0	7.1	6.5
Roads in medium (½) speed range ...	11.0	10.8	10.1	9.6
Roads in highest (¼) speed range ...	16.3	16.2	15.4	14.5

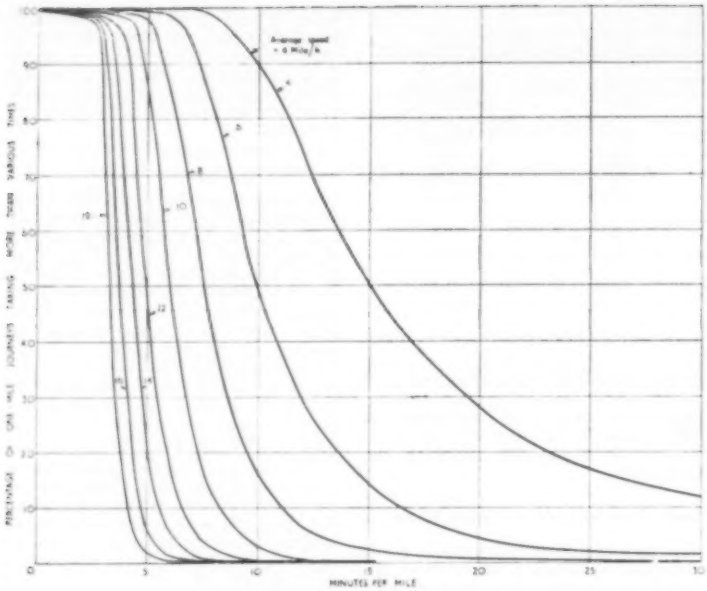

Fig. 1. Distribution of journey times for a one mile journey at various assumed average speeds.

countries has often been associated with a decrease in the use of public trar sport, especially within urban areas. The tendency has been very marked in the United States and Great Britain, as is shown in Table 7 on facing page.

In the United States, passengers carried by local passenger transportation services dropped an average of 7 per cent per year between 1950 and 1958. In the same period in Great Britain the number of passengers using the road services operated by the local authorities outside London fell by 2.3 per cent per year, the number of passengers using the road services of the London Transport Executive fell by 5.3 per cent per year and the number of journeys by public transport in London as a whole fell by 3.6 per cent per year. It is of interest that in Detroit, a city which has an especially low density of population, the number of passenger journeys dropped from 492[1] million in 1945 to 148 million in 1959, a decrease of 8.2 per cent per year.

Basic data on which the capacity of roads, railway tracks and footways were calculated are then given and the results are summarized in Table 8 on facing page, and conclusions were reached as to the carrying capacity of a carriageway when used in different ways.

Calculations were made of the area of carriageway required for a journey and Table 9 on page 48 gives the area required per person during the peak period for a one mile journey.

In considering the social costs of road travel, numerical estimates were made of the slowing down effect on other vehicles of a vehicle in motion and the effects of a vehicle parked near a controlled intersection. Regarding the first, the following conclusion was reached, while the time loss to other vehicles caused by a single extra car (vehicle hours lost per mile travelled) is given in Table 10 on page 48.

Whilst the time losses caused to other vehicles by the passage of an extra vehicle is often small, these time losses are appreciable in quite commonly occurring circumstances. An extra car travelling for one mile on a road where the average speed is 5 mile/h will cause a total loss of 0.56 vehicle hours to other vehicles. An extra bus travelling along a road where the average speed is 5 mile/h, will cause a total time loss of about 1.7 vehicle hours to other vehicles, assuming one bus equivalent to three passenger cars as far as its effect on other traffic is concerned. These time losses imposed on other road users are sometimes large but time gained by the motorist might, however, be greater than the time loss he imposes on other road users. Even if this is not so, the economic value of the time gained may be greater than the economic value of the time lost to other road users. These matters will now be considered.

Delay caused by Parking

Quantitive knowledge is now available[2] on the effect of a vehicle parked near a controlled intersection, on the number of other vehicles that can pass through the intersection per unit time and on the delays experienced at controlled intersections[3]. This knowledge makes it possible to estimate the effect of a single parked vehicle on the time taken by other vehicles to pass through the intersection. The appropriate analysis has been carried out and some results of the calculations appropriate to a few special cases are given in Table 11 on page 48.

The table shows that if a vehicle parks close to the intersection, the time losses it imposes on other vehicles is

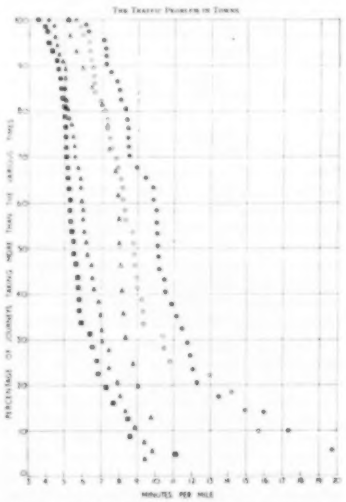

Fig. 2. Distribution of journey times for a journey of approximately one mile.

TABLE VI

Mean and Standard Deviation of Traffic Speeds in Test Runs on a Selection of Roads

	Mean speed (mile/h)	*Stand'd dev'n about mean (mile/h)*	*Coefficient of variation*	*Number of journeys on which based*
Selection of roads in London	5.7	1.8	0.32	30
	7.1	1.8	0.25	
	8.2	1.8	0.22	
	9.2	2.0	0.22	
	12.8	2.3	0.18	
	13.3	2.7	0.20	
	13.4	3.6	0.27	
	19.7	2.8	0.14	
	21.9	2.9	0.13	
Selection of roads in Glasgow	7.5	1.7	0.23	40
	8.4	2.0	0.24	
	8.9	1.9	0.21	
	9.9	2.1	0.21	
	10.5	2.3	0.22	
	11.9	2.4	0.20	

TABLE VII

Trends in Numbers of Urban Passenger Journeys (millions)

Year	U.S.A.	Great Britain				
	*Revenue passengers carried by local passenger transportation services**	*Buses, coaches, trolley bus and trams operated by local authorities*	*London Transport Executive*		*British Railways London lines*	*Total London*
			Road services	*Rail*		
1950	13,845	7,102	3,841	695	450	4,986
1951	12,881	6,955	3,869	702	455	5,026
1952	12,022	6,762	3,711	670	456	4,837
1953	11,036	6,577	3,655	672	456	4,783
1954	9,858	6,549	3,495	671	492	4,658
1955	9,189	6,522	3,404	676	479	4,559
1956	8,756	6,361	3,220	678	491	4,389
1957	8,338	6,128	3,117	666	504	4,287
1958	7,778	5,913	2,484	692	527	3,703
1959	—	5,724	2,756	669	507	3,932

*Sources: Statistical Abstract, United States, 1959 and 1960, United States Department of Commerce.

'Statistics of Public Road Passenger Transport in Great Britain, 1950', *et seq.*, Ministry of Transport, H.M.S.O.

British Transport Commission, Annual Report and Accounts, 1950, *et seq.*, British Transport Commission, H.M.S.O.

TABLE VIII

The Carrying Capacity of a Carriageway when used in Different Ways

	Persons per foot width per hour	*Speed (mile/h)*
Urban street, 24 ft. wide, mixed traffic		
Cars with driver only	25.5	15
	41	10
Cars with 1.5 persons	38	15
	62	10
Cars with 4 persons	102	15
	165	10
Buses with 32 persons	272	8.6*
	440	6.7*
Urban street 44 ft. wide, mixed traffic		
Cars with driver only	45	15
	63	10
Cars with 1.5 persons	67	15
	95	10
Cars with 4 persons	179	15
	254	10
Buses with 32 persons	478	8.6*
	676	6.7*
Urban motorway (capacity per foot width is independent of width)		
Cars with driver only	125	40
Cars with 1.5 persons	187	40
Cars with 4 persons	500	40
Footway	800	2.5
Urban railway line	2,900	18
Suburban railway line	2,200	30

*This has been calculated by assuming that a bus requires 3 minutes per mile for stops, deceleration and acceleration.

sometimes very large. Thus, if a car is parked for 10 minutes 25 ft. away from the stop line on the approach side of an intersection, through which 800 cars or their equivalent in other vehicles are running per hour, it causes time losses to other vehicles of 5 vehicle/minutes if the approach width is 24 ft., 21 vehicle/minutes if the approach width is 20 ft. and 55 minutes if the approach width is 16 ft. If the vehicle is parked for 30 minutes, the time losses for the two wider approaches are approximately trebled and for the narrow one about six times as much. If the traffic flow is 1,000 cars per hour, the time losses caused by the vehicle parked 25 ft. from the intersection are 11 vehicle/minutes if the approach width is 24 ft., 80 minutes if it is 20 ft. and 290 minutes if the approach width is 16 ft. If the parked vehicle stays for 30 minutes, instead of 10, the time loss on the widest road is trebled but time loss on the narrowest one is multiplied by nine and becomes 2,600 minutes. The time losses caused by parked vehicles at congested intersections are therefore sometimes very large and probably, sometimes, out of all proportion to the gain to the driver or owner of the vehicle parking.

Duration of the Effects on Delay

If, as is sometimes the case, the effect of the parked vehicle is to reduce the capacity of the intersection below the rate at which vehicles are arriving, a queue of increasing size builds up and much of the delay to other vehicles is experienced after the parked vehicle has left. This queue may not be finally dissipated until some time after the parked vehicle has left.

The maximum delay to an individual vehicle was analysed and the calculations show that a car parked for 30 minutes, 25 ft. from an intersection 16 ft. wide, at which 1,000 cars are arriving per hour, will cause delays totalling 2,600 minutes to other vehicles. The vehicle delayed most will be delayed for about four minutes. Tables 9, 10 and 11 are on page 48.

REFERENCES

[1]'Individual and Mass Transport in Urban Areas' by A. F. Malo. Proceedings of the 5th International Study Week in Traffic Engineering. Published by World Touring and Automobile Association. (O.T.A).

[2]Road Research Technical Paper (not yet published).

[3]Road Research Technical Paper No. 39 by F. V. Webster.

University of Durham Traffic Symposium.

Certain of the papers presented at Newcastle upon Tyne will be published in the June issue.

TABLE IX

Area Required per Person during the Peak Period for a One Mile Journey

	Area (sq. ft.)
Urban street, 24 ft. wide, mixed traffic	
Cars with driver only	105
	64
Cars with 1.5 persons	69
	42
Cars with 4 persons	26
	16
Buses with 32 persons	10
	6
Urban street, 44 ft. wide, mixed traffic	
Cars with driver only	59
	42
Cars with 1.5 persons	39
	28
Cars with 4 persons	15
	10
Buses with 32 persons	6
	4
Urban motorways	
Cars with driver only	21
Cars with 1.5 persons	14
Cars with 4 persons	5
Footway	3
Urban railway line	0.9
Suburban railway line	1.2

TABLE X

Time Loss to Other Vehicles caused by a Single Extra Car
Vehicle/hours lost per mile travelled

Journey speed v (mile/h)	4	5	10	15	20	25
Vehicle/hours lost by other vehicles	0.92	0.56	0.105	0.031	0.009	0

TABLE XI

Total extra delay (minutes) to other vehicles due to a parked vehicle
(cycle time 1 minute; proportion of green time per cycle 50 per cent)

Approach width (feet)	*Distance of parked vehicle from stop line (feet)*	*Duration of parking (minutes)*	*Flow (passenger car units per hour)* 800	1,000	1,200	1,400
16	25	10	55*	290		
		30	310	2,600		
	75	10	50*	240		
		30	290	2,200		
	150	10	16	150*		
		30	47	1,250*		
20	25	10	21	80*	358	3,400
		30	62	650*	3,320	31,000
	75	10	8	33	125*	1,500
		30	25	99	1,000*	14,000
	150	10	2	6	27	170
		30	6	17	81	1,500
24	25	10	5	11	38	125*
		30	14	33	114	1,100*
	75	10	3	6	17	100*
		30	9	19	51	700*
	150	10	1	2	5	15
		30	3	7	15	44

N.B. The blank spaces are due to the fact that the numbers of vehicles could not get through the intersection in the available green time, even in the absence of a parked vehicle.

*Estimated by interpolation.

LETTERS to the EDITOR

from R. Edmonds

Chairman, L.C.C. Roads Committee

It would seem from the paragraph headed 'Roads for London', in 'Topics of the Month' in your March issue, that you are under a grave misapprehension regarding the work of the London County Council in traffic engineering.

The scientific collation of data and the study of the application of traffic engineering techniques has been practised by the Council for the last 30 years and the Council has employed fully qualified staff on the work. It is unfortunate that the application of these techniques to development schemes has been hampered, even after the stop in developments imposed by the war, by the Government's financial restrictions.

The recent more helpful financial policy of the Government in relation to road development is enabling the Council to increase the volume and speed of the work, and, for this reason, a new Roads Committee has been set up to deal with it. The work was formerly under the control of the Town Planning Committee and it is only this recent division of responsibility between the two committees which has necessitated the setting up of a joint sub-committee to consider road schemes involving planning consideration. It is certainly not a new thought to the Council that road schemes involve planning consideration.

The setting up of a separate Traffic Engineering Division in the Chief Engineer's Department is again necessitated by the increased volume of road work which the Council intends to undertake. The division urgently needs recruits and it is hoped that the great expansion of the works will make young engineers feel confident that they can take up traffic engineering as a career.

The County Hall, London, S.E.1.

from P. W. Miller

In 'Topics of the Month' in the March issue, the inadequacy of training facilities for traffic engineers in this country is commented upon. I hope that this view also embraces the lack of financial support available to students who wish to attend a course.

It appears that unless a post graduate applies for a D.S.I.R. grant in March, he is unlikely to be considered for a grant to enable him to start a one-year's course in October of the same year. I am aware of an applicant who appealed to an education authority and was told that it was normal for a post graduate course to be financed by D.S.I.R. As it was September before he decided to attend the course, he received no support from either the education authority or the D.S.I.R.

Would it be possible for any of your readers to suggest any bodies prospective students could approach who would consider assisting students to gain knowledge of traffic engineering, so essential if this country is not to fall behind in this most important field?

28 Halsham Crescent, Barking.

INSTRUMENTATION for TRAFFIC STUDIES

by J. A. HILLIER
Principal Scientific Officer, Traffic Section, Road Research Laboratory

An informal discussion was held at the Institution of Civil Engineers Traffic Engineering Study Group on March 9 on 'Instrumentation for Traffic Studies'. It was opened by Mr. Hillier whose prepared paper is reproduced below.

Peta, the portable electronic device for measurement of speed, manufactured by Marconi and in wide use by police authorities in Britain and overseas. Photograph by courtesy of Marconi Wireless Telegraph Co. Ltd.

TRAFFIC engineering should be based on factual information about traffic behaviour and it includes studies of the effect of various control measures. The purpose of this paper is to describe some of the instruments which have been developed to assist in the collection of traffic data.

In the early stages manual methods were used exclusively and even now the simple techniques involving stop-watches and simple hand counters are used to a much greater extent than the more complex automatic methods. However, as the scale of studies grows, the need for quicker methods of collecting large amounts of data has become apparent and a number of instruments are now available, some commercially, for the use of the traffic engineer.

Manual Aids

The most frequently used simple aids to manual observations are hand tallies and stop-watches. Hand tallies can be obtained from at least two manufacturers, one of which supplies units mounted together to form multi-bank counters of particular value when making classified counts.

The type of stop-watch recommended varies with the job being undertaken. The most useful design for general purposes has a dial marked in hundredths of a minute and a 'split-second' hand which can be stopped temporarily to record an event and then returned to coincide with the main second hand. Commercially available stop-watches range from those which record in one-tenth of a second for three minutes to those which record in seconds for 12 hours. The price of a reliable 'split-second' watch recording in one hundredth of a minute up to 30 minutes is about £15. When making manual observations a recording board to which the recording forms and stop-watch can be securely fastened is most useful. The lanyard is a valuable safety precaution when making observations from roof tops or other high vantage points.

Automatic Traffic Detectors

One of the more important factors considered in traffic studies is the flow of vehicles, normally measured in terms of vehicles per hour. Although manual methods are adequate for short jobs and provide the only reliable method of classification, it is more satisfactory to use automatic counters when carrying out long-term counts to establish monthly or yearly trends. Traffic counters consist of two main parts, the detector which senses the passage of vehicles and the counter which records the number of pulses transmitted by the detector.

Several designs of detector are available, the most common being the pneumatic detector consisting of tyre-quality rubber tube approximately $\frac{1}{2}$ in. o.d. to $\frac{1}{4}$ in. i.d. This is stretched across the road, so that the tube lies closely in contact with the road surface, and the passage of vehicle wheels over the detector causes an impulse to be transmitted through the air in the tube to a light diaphragm switch in the counter. The rate of transmission of pulse is about one foot per millisecond, approximately the speed of sound, and it is important to place the detector at right angles to the passage of the vehicle so that each axle records as one unit. If detectors are placed obliquely to the line of movement of the vehicle each wheel will count. It is important that detectors should be correctly terminated to prevent unwanted reflections from the far end causing extra counts when a heavy vehicle passes; a termination plug has been developed which effectively cancels out these reflections. If detectors are left unattended the Ministry of Transport requires that they should be fastened down approximately every three feet, and the best method we have found is to use canvas-brass clips. The use of rubber tube detectors on motorways, however, gives rise to further problems, particularly with regard to the safety of the staff maintaining the installation. As a result special detector fastenings have been developed for use on the M1. They are designed to be installed permanently in the road surface and to carry the detector tube freely so that a fresh tube can be connected to the old one and pulled through from the side of the road. Provision is also made for a duplicate detector to be laid parallel with, and a few inches away from, the first detector, so that in cases where a detector is becoming buried in a bituminous carpet in hot weather the site of the detector can be shifted periodically. These detector fastenings have been used successfully for over a year, but it may be that further modifi-

cation of the design will take place with greater experience of their use.

Automatic Traffic Counters

There are two forms of traffic counter commonly used; a simple accumulating counter and a much more complex recording counter.

The simple accumulating counter consists of a light diaphragm switch, an electro-magnetic counter unit and two six-volt dry batteries. In the diaphragm unit the energy contained in the air pulse is used to push a light beryllium copper diaphragm and cause the momentary closure of two contacts normally spaced about ten-thousandths of an inch apart. The sensitivity of the diaphragm unit can be adjusted by varying the size of this contact gap. The electro-magnetic counter unit is designed to give the best possible life from the batteries consistent with an adequately fast speed of operation. It has been found unwise to attempt to design these counter units to operate too rapidly; the Syx-R.R.L. No. 4 counters operate on a contact closure of about 4½ milliseconds and have a 'dead time' of about 40 milliseconds. The life of the counter unit is largely determined by the small cyclometer type counter, which is not really designed to work as fast as it is required to in this instrument. The average life between counter failures has been found to be about 750,000 nominal vehicles, which is very close to the average life of the cyclometer unit itself although some cyclometer units last much longer than this. The life of the dry batteries is approximately three months or one million vehicles, whichever occurs first.

The recording traffic counter most frequently used in this country is of American origin, made by the Streeter-Amet Company of Illinois, but it is likely that similar counters will be available in England in the near future. This instrument is much more complex and costly than the simple accumulating counter, since, in addition to a diaphragm unit of similar design to that used in the simpler instrument, there is also provision for printing the recorded counts every hour, together with the time at which the counts were completed, on a strip of paper. The counter resets itself each time it prints. The power for the counter is supplied by a six-volt accumulator contained in the base of the instrument and the spring driven power clock used to release the printing mechanism is readily accessible at one side. These counters require more elaborate maintainence facilities than the non-recording counters and cost approximately six times as much. The supply of paper tape is sufficient to last several months. The accumulator will last for at least two weeks if fully charged but we prefer to change them on a regular basis rather than wait until they show signs of running down. The power clock will last for at least eight days, but owing to the changes in temperature which can be experienced inside a box standing in an exposed position, we find it desirable to visit each counter at least twice a week, if possible, in order to check with an electronic clock-timing device.

American recording counters received from the makers are not adequate to deal with the greater variety of vehicles encountered in British traffic. We therefore incorporate several modifications before the counters are put into service. Briefly the modifications consist of:

(*a*) a faster pick-up relay, to record light fast cars more accurately;

(*b*) the replacement of the plastic diaphragm by a beryllium copper diaphragm, which also involves insulated bush mountings for the diaphragm unit;

(*c*) an improved clock regulating device;

(*d*) a change in the position of the detector input so as to minimize the chance of a loop in the tube which would be dangerous to pedestrians.

In addition to the two instruments already described there are other counters available commercially. The Tyer Trafficorder records a week's traffic flow on a paper chart stretched round a drum, each vertical line on the chart representing the flow in a given hour. The Elmeg counter manufactured in Germany produces a printed record similar to that given by the Streeter-Amet R.C.H., but with the addition of date information. This instrument also provides a running total of the traffic. Another development by Streeter-Amet is a photo-electric permanent station counter which employs a recording mechanism very similar to that already described, but operating from the mains and therefore capable of unsupervised use for as long as the paper tape lasts. It is used in conjunction with twin photo-electric cell detectors and is consequently subject to the difficulties of operation of this form of detector. Since their accuracy drops off seriously with increasing traffic flow this form of instrument is most suited to rural conditions.

Vehicle Presence Detectors

Most of the detectors currently in use depend for their operation on the movement of the vehicle being detected. This is true of the pneumatic detectors, the positive contact detector, the photo-electric detector and most forms of wire loop detector. Consequently, if such detectors are used in conditions where traffic is liable to come to a complete standstill, the apparatus with which they are used is not able to distinguish the difference between a traffic jam and the complete absence of traffic.

One vehicle presence detector, which has been developed from a commercially available metal detector, consists of two closely associated loops placed on or just below the road surface, the first carrying a 2 Kcs. signal and the second used as a search coil to detect the presence of metal. When a vehicle passes over the detector, the field produced by the first coil is distorted by the metal of the vehicle and the change in the electro-magnetic field produces a signal in the search coil. This signal is present for as long as there is metal inside the effective area of the loop. The instrument has also been designed with a feature which makes it insensitive to small changes in loop geometry, adding considerably to the stability of the detector in use. This form of detector can be used with a loop of, say, 8 ft. x 6 ft. to detect the presence or absence of vehicles in a queue, or at a prohibited parking place, or in a tunnel where the build-up of a queue might be dangerous. A further application of this detector is that it can be placed round a roundabout, forming a large loop up to 800 ft. in circumference. With a suitably modified instrument it is possible to record when the number of vehicles round the roundabout reaches a predetermined critical level, thus indicating imminent locking up. The only other commercially available detector which will sense the presence of vehicles is manufactured in America and has not yet been distributed in Britain. It consists of ultrasonic transmitting unit producing pulses at the rate of about 40 per second. It is mounted vertically above the traffic and can detect the difference between the path length of pulses which strike the ground and those which are reflected from the top of a vehicle. It will, therefore, record the presence of a vehicle whether moving or stationary. The radar detector used in the U.S.A., for traffic signals and counting on freeways, is not suitable for the detection of congestion of stationary vehicles since it is simply a modification of the radar speed meter which employs the Doppler effect.

The output signals from a vehicle presence detector placed in a traffic lane can be used to measure the density of the traffic stream. A particular application is the detection of actual or impending congestion. A unit has been built which averages the occupancy of the presence detector during the past minute or so. This average density has been correlated with visual assessments of congestion. In the case of an 8 ft. x 4 ft. loop on a traffic signal approach, congestion corresponded to densities of 0.7 or greater and free running conditions to densities of 0.3 or less.

Detector Speed Meters

Most speed meters work on the principle of measuring the time of passage of a vehicle over a known length of road. They range from the simple stop-watch timing vehicles over several hundred yards to electronic devices capable of accurate timing over a few feet. Many techniques are available, electrically operated stop-watches with pneumatic detectors, multi-pen chart recorders with pneumatic detectors, stepping switch timers for measurement of journey time over, say 20 ft. and dekatron or transistorized decade units for counting clock pulses produced by a crystal controlled oscillator whilst the vehicle travels only five or six feet. In this country the Venner speed meter is commercially available. It consists of a 2½ Kcs. crystal controlled oscillator supplying clock pulses to three decade counters. It is fully transistorized and is powered by two six-volt lantern dry cells. If the detectors are placed 70.4 in. apart, then the reciprocal of the count given on the meters shows the speed of the vehicle in miles per hour. This instrument has been further developed to produce a punched paper tape record of the classification and journey time of the vehicles sampled. All parts of this equipment are not yet commercially available, but it has been used successfully by the Road Research

Laboratory in various large-scale speed studies. The operator selects and classifies the appropriate vehicle by the operation of joy stick controls. Up to 16 classifications are possible and the maximum rate of recording is about two per second. A computer programme has been written which will allow these paper tapes, when suitably edited to include traffic flow information, to be directly analysed giving frequency distributions of five miles per hour groups, mean speeds, standard deviations and flow information in each of the categories and also for all vehicles combined.

Detectors for Speed Meters

Adjustable diaphragm units to be used with pneumatic detectors for speed measurement are not yet commercially available. However, the design of the diaphragm unit in the Syx-R.R.L. traffic counter is such that it can readily be mounted as a unit, in a small aluminium casting, for this purpose.

Since the speed of transmission of the pulse along a pneumatic detector is approximately that of sound in air, about one foot per millisecond, and the operation of the diaphragm switches takes an appreciable time, it is clear that when using pneumatic detectors with speed measuring devices employing a short distance base, errors may creep in due to the unequal length of time taken for pulses to reach the equipment from each of the two detectors. Although studies have shown that with reasonable care it is possible to use pneumatic detectors and diaphragm units without any difficulty, for some special purposes it has been found desirable to use positive contact detectors when measuring speeds very accurately. The positive contact detector consists of two pieces of metal which make contact when the vehicle passes over them, giving an instantaneous indication of the arrival of the vehicle wheel. Several forms of positive contact detector have been devised. Among them are segmented detectors, in which the operation of each separate foot of detector can be separately recorded, but the most usual is a detector stretching across a single lane of traffic in order to measure speeds. A successful design, which is available commercially if sufficiently large quantities are ordered, is made by the Dunlop Rubber Company and consists of two spring steel elements encased in a moulded rubber covering. The first element consists of a length of expanding curtain rod, covered with an open helix of insulating material and placed above a spring steel wire formed roughly into a sine-wave with about one inch amplitude and period. The helix of insulating material is normally sufficient to maintain the two elements out of contact. This type of detector has proved very robust and suitable for repeated laying and removal. A similar detector, with a rather simpler assembly moulded inside polythene, is produced in the United States and may be available commercially in the near future. Positive contact detectors are more expensive than pneumatic detectors, rather more difficult to maintain accurately in position on the road surface, but simpler to operate since they do not require any diaphragm switches.

Radar Speed Meters

The radar speed meter operates on the principle of comparing the frequency of a transmitted radio signal with that reflected back from any moving object within its field. The change in frequency is proportional to the velocity of the object relative to the radar speed meter and is independent of the direction of motion of the object.

At least three radar speed meters are commercially available at the present time. The instrument with which most experience has been gained in this country has been available in America for more than 10 years. It is manufactured by Eastern Industries and consists of a transmitter and receiver unit tuned to 2455 megacycles. Its range is about 150 ft. and it projects the equivalent of a broad beam with a totally enclosed angle of about 40°. The answers are presented on a voltmeter, which is calibrated in terms of miles per hour, and which is read by direct observations. Marconi's Wireless Telegraph Company have a more sophisticated form of radar speed meter, developed in conjunction with the Lancashire Police. In common with the American instrument it works on the Doppler principle, but its transmission aerial consists of a slotted wave guide providing a very narrow beam which is angled across the road at approximately 20° to the line of movement of the traffic. This means that vehicles can be individually sensed but, since each is in the beam for such a short period—particularly at high speeds—it is necessary to incorporate an electronic 'hold' circuit to maintain the reading on the meter for a period of about one second, in order to give the observer time to read it. Other radar meters are available on the Continent and one is distributed in this country by Electro Mechanisms Ltd., of Slough.

Paper Tape Recording Equipment

When it is necessary to record rapidly a large amount of traffic data which is likely to occur at any time during the recording period, it has been found convenient to use a recording unit based on the standard teleprinter paper tape reperforator. This unit produces a five-channel punched paper tape, about five-eighths of an inch wide, of the same type as used in the recording speed meters. Control units have been built at the Road Research Laboratory which enable simple counts, coded counts and other coded information to be automatically punched in the five channels when the appropriate push button is operated. The equipment is very versatile and has been used to measure vehicle speeds, journey times, petrol consumption, reaction time of drivers, headways and traffic densities. This equipment has also been used as automatic recording equipment in survey cars travelling on routes in London. Although it was necessary at first to use special purpose machines for the automatic analysis of the tape, it is now possible to use electronic computers and programmes are available to enable large quantities of traffic data to be analysed automatically.

Surveys of traffic flow and speed over a road network can be carried out from a test car carrying observers to record data relating to each section of street. This can be done using watches and hand tallies or with the punched paper tape equipment mentioned above. Simplified recording equipment has been developed which offers some advantages in projects too large for manual analysis yet too small to justify the use of a computer. The operator has push buttons which are pressed at each stop and start of the vehicle whilst queueing, and a changeover switch which is operated as each new section of route is entered. On the completion of each section 'stopped times' and 'journey times' are displayed on resetable electric counters, thus eliminating the need for subtractions or the recording of intermediate starting times when queueing.

Mr. J. A. Hillier finally pointed out that the Road Research Laboratory did not believe that every traffic engineer should possess every piece of this equipment. They regarded some of the simpler instruments as essential, but had developed the other and more complex equipment partly because of research interest. They felt that these more complex pieces of equipment might never be of direct interest to the normal traffic engineer, but the results obtained from them might be useful.

The Report of the Traffic Engineering Study Group Discussion on the paper presented by Dr. F. V. Webster on Future Developments in Traffic Signals is held over until the June issue.

next month

- **ROAD USER BEHAVIOUR AT A PEDESTRIAN CROSSING**
  S. J. OLDER and JULIA M. BASDEN, Road Research Laboratory
- **ENFIELD TOWN CENTRE—PARKING AND PEDESTRIAN PROPOSALS**
  H. D. PEAKE, Borough Engineer and Surveyor, Enfield
- **ACCIDENT FREQUENCY AT CROSSROADS WITH AN ALL-RED PERIOD**
  R. F. NEWBY, Road Research Laboratory
- **REVISED TRAFFIC CONTROL DEVICE MANUAL (1) SIGNS AND MARKINGS**
  BURTON W. MARSH and WILLIAM L. CARSON, American Automobile Association

PROFILE

Professor J. Kolbuszewski

'NOT a profile of me! A Profile of the School, please,' asked Professor Kolbuszewski, meaning the Graduate School in Highway Engineering at Birmingham University, incorporating the first Chair of Highway and Traffic Engineering to be established in this country.

'A man doesn't matter,' insists the Professor, holder of this Chair and Head of the School. 'There would have been someone else to fight, if not me. It was obvious years ago that training would be needed to provide people to provide roads.'

All the same, it is difficult to dissassociate the man from the scheme, as he walks mercurially up and down, enthusiasm pouring from him. Slightly built, with greying fair hair and light eyes, he is none the less very much a presence, even to the detail of excellent grooming. His fluent speech has hardly a trace of his original Polish accent, but a highly individual vivacity of phrase.

'Someone else would have done the crystal gazing. In fact—if anybody understood, it was industry. All the same, we had no financial help from them at first, except from the Worshipful Company of Paviors, who established our Lectureship in Highway Engineering'.

Following a meeting in 1958 between Sir Richard Nugent, then Joint Parliamentary Secretary to the Ministry of Transport, and a number of industries, the School was enlarged from the original size previously started out of the resources of Birmingham University's Department of Civil Engineering. It owes an enormous debt to the faith and generosity of the members of other departments and faculties, acting as lecturers. The first year there were eight students, then 16, then 25. At last came financial help from industry, but it still took two years for buildings to be erected and equipment installed, the School meanwhile carrying on in odd corners, corridors and attics, even behind cupboards. Now there is a nucleus of buildings, the interiors of which are impressive. One enters through modern glass doors into Scandinavian airiness, to climb a handsome staircase up to Professor Kolbuszewski's room, appropriately stream-lined, with flush doors and shelves, and set out with contemporary furniture.

The School accepts only students who already have a good honours degree in civil engineering, or the professional equivalent, and with at least two years' practical experience in industry or with a public authority. The course is for a year, and includes lectures, research projects, laboratory and field work and three months' practical work in industry, traffic engineering or road construction. Research is often in close relationship to the experiments of the Road Research Laboratory, the Deputy Director of which, Dr. R. J. Smeed, is External Examiner to the School.

Great, however, as is the importance given to the subject of traffic engineering, the policy is against an isolated point of view. How can traffic engineering be divorced, for instance, the Professor demands, from material and construction with its studies of concrete, bitumens, asphalts, etc. How can it be separated from electrical engineering and its instrumentation, even from the economics of transportation, the increase of cars with the increase of income, the impact of taxation, and so on?

Professor Kolbuszewski insists on the importance of not diffusing forces. Experts from industry, public authorities, professional organizations, and distinguished British and foreign scholars might not lecture so freely, if imposed upon too much. Similarly, Professor Kolbuszewski believes it only practical to have a concentration on one centre of prestige till more people are trained in this still new subject. Whatever the rights and wrongs of all this, it is certain that the work and standards achieved are the School's best advertisement. Overseas scholars take back not only their learning and honours, but also the potential of trade and custom. Industrial firms which first, gingerly, sent members of their staff to the course, now annually repeat the experiment. One of the supporters of the School is Scotland Yard, and Professor Kolbuszewski would like to see the closest co-operation with the police of the whole country.

'Every public holiday children are going to be killed on the roads,' he declares in his graphic way. 'They will go out to play and they might not come home again. The police are a vital

(*Concluded on page* 54)

Meters in Auckland

by **N. A. LAKE,**
A.M.Inst.T., Superintendent of Traffic

THE City of Auckland, New Zealand, was the first city in the British Commonwealth to install parking meters and during the past seven years, 1,900 meters have been brought into use. The City Council is empowered to introduce parking meter schemes under a by-law under which it can, by resolution, declare any street or part of a street to be a metered zone; declare the number and situation of metered spaces within a metered zone; declare the time allowed for parking in such spaces and fix the fees payable for the parking of vehicles within them.

The first 900 meters received were paid for in two years from the revenue obtained and it is now found that applications are being received from business concerns in the suburbs for the installation of parking meters outside their premises to relieve the chronic congestion caused usually by all-day parking of motor vehicles and also to encourage customers to park for a short but reasonable time.

It has been found that the parking meters have given motorists a fair share of the available kerb space and at the same time proved a source of revenue for future off-street parking ventures by the City Council. While some opposition was experienced with the initial installation of parking meters, it was short lived and meters are now accepted as a part of the City traffic system. Surplus revenue from parking meters is reserved to provide facilities for the motorist, such as parking buildings and off-street parking areas, and a depreciation account is also set aside to provide for replacement of existing meters.

The present Auckland Metropolitan Area embraces some 177 square miles with a population of approximately 450,000, while car registrations total approximately 160,000 motor vehicles. For the financial year ended March 31, 1960, the sum of £59,456 was collected in fees, an average of £31. 5s. 0d. per meter. Maintenance costs for the same period amounted to £3,285, together with collection costs for the services of one collector and van, £1,775. Maintenance of meters is by

Fig. 1. Parking meters carrying advertisements in Queen Street, Auckland, the main down-town shopping and business area. Maximum parking time is one hour with a charge of threepence per half hour to encourage short term parking.

Fig. 2. Beach Road, Auckland, within approximately a quarter mile of the main shopping centre of Queen Street, showing municipal owned and controlled multi-storey garage in background with six floors and accommodation for 475 cars. Parking meters are provided along the street.

contract but the collection of revenue is made by the Council itself. Maintenance costs include the resiting of parking meters at various areas where traffic conditions require the clearance of the kerbside for use of additional lanes for moving traffic.

The parking meters are Duncan Miller manual type, that is a motorist inserts the prescribed coin and turns the lever to wind the mechanism. It is considered that this type is more suitable than the automatic machines in that costs of additional personnel are saved by the driver attending to the necessary operation of the meter.

The cost of meters is £33. 10s. 0d. each and initial installation costs are £1. 10s. 0d. per meter, including the street marking of the defined meter parking space for each individual meter.

Complaints regarding parking meters are very seldom received, while the meters themselves, including the initial installation, are giving excellent and practically trouble-free service. This is attributable to the regular maintenance service, besides the quality of the workmanship in the parking meters.

The charges in Auckland City are threepence per half hour and in the busier streets it has been found worthwhile to enforce a maximum stopping time of one hour to ensure that the long-term parker does not leave a vehicle to the detriment of others desiring kerb space. The meters with a maximum time of parking have the standard painted red and the words 'Maximum Time' are stamped on the meter in view of the user. Appropriate 18 in. x 12 in. signs are also erected at intervals along the kerbside to advise drivers of the maximum parking time in meter areas. The majority of meters in the shopping or business area of the City allow for half hour parking with a maximum of one hour in some cases, but as the meters extend away from the busier areas, so a proportionately longer time is allowed for parking and it is extended in some instances up to two hours.

Outside the Central Post Office, 15 meters have been installed with a maximum time of 15 minutes with a threepenny fee. This is a very busy area where most drivers stop for a short period only and so longer term parking is discouraged, not only to provide a facility but to reduce the likelihood of congestion in this particular area.

With commercial or goods service vehicles, it is provided in the Council's By-laws that such vehicles may load and unload goods at the metered spaces without charge. This has eliminated the necessity of providing special loading zones for commercial vehicles.

The Council has also invited tenders for advertising on parking meters and this has proved very successful, with the advertising matter placed on a suitable frame on the meter standard so that it does not in any way interfere with the meter head or its operation.

Enforcement

Traffic Officers are employed for enforcement purposes and attend also normal traffic enforcement duties in conjunction with their patrol on light-weight motor cycles in the busy City streets. Should the driver not be present to receive the ticket in case of an offence, then the notice is placed on the windscreen. This is returned by the driver or person responsible to the Traffic Department with his explanation. Consideration is then given as to action to be taken such as warning or prosecution.

It has been found that one Traffic Officer on a light-weight motor cycle can supervise from 300 to 350 meters. It has also been found that meters encourage good public relations between the enforcement officer and offender in that the time for parking is always visible and the time expired flag is usually sufficient evidence for the Traffic Officer to issue a ticket, after the expiration of at least two minutes in compliance with the provision of the law.

Payment by Post

There is no system of payment on the spot for parking offences but there is a postal system whereby the offender is informed of the penalty and, if he so desires, he may forward the amount, which is set by schedule, to the magistrate's court. If payment of the fine is not made within two weeks after receipt of the letter, the usual course of serving a summons is adopted. This applies particularly to persons who may desire to enter a plea of not guilty; this gives them the opportunity of appearing before the magistrate to state their case. The Department also has the option of referring information, such as for instance persistent offenders, direct to the court.

PROFILE

(*Concluded from page 52*)

factor in accident prevention. But without knowledge of the latest traffic studies, they are like doctors prescribing medicine and not knowing physiology.'

It is clear that believing nobody is irreplaceable does not mean disregard for the value of human life. Perhaps the details of Professor Kolbuszewski's own story have suggested to him that chance may be as important as capacity. Born in Poland and educated as a civil engineer, he was already a lecturer at the University of Lwow when war broke out. By the end of it, he had served in three armies, the Polish, the French and the British. There was no going back, but fate was to be kind, allowing him ultimately to continue in university life, which he had always loved, first enabling him to help build up a Polish University College in London, then, in 1951, taking him to Birmingham, where he has risen from Lecturer in Civil Engineering to his present position.

Professor Kolbuszewski has in common with a high proportion of traffic engineers the ability to sink himself in something which is a complete release and relaxation. He paints in oils and water colours, and is no less happily lost to the world because he burns his canvasses afterwards. He also reads thrillers — Simenon preferred — and history.

His wife is Polish, but they have two 'very British' children, who can hardly though, be more patriotic than their father. 'You British always undervalue yourselves.' he accuses. 'Why won't you realize you still have the lead—in the present as in the past—especially in industry? I can say it for you. You do not know how to sing your own praises, blow your own trumpets, beat your own drums,' and he walks quickly back and forth for emphasis.

R.L.

TWELVE MONTHS PROGRESS

Fig. 1. Inner Ring Road, Birmingham (G.E.C.).

by Granville Berry, M.Inst.C.E., M.Inst.Mun.E., A.M.I.W.E.
City Engineer and Surveyor, Coventry.

IN the past twelve months, at home and abroad, there has been an increasing realization of the importance of good lighting to the highway system, and a marked tendency towards the adoption of higher levels of illumination and the use of colour corrected mercury lighting in city streets where fluorescent lighting would have previously been installed. At the same time an impetus has been given to the co-ordination of street lighting in large conurbations by steps taken to set up further consultative committees in Lancashire, Cheshire, Merseyside and the West Riding of Yorkshire. These committees together represent a large number of local authorities and can do much to encourage better and more uniform standards of lighting on through roads in these areas.

Lighting of Motorways

In the United States work has proceeded on the lighting of expressways, and work is well advanced on the installation of sodium lighting on the Rotterdam/Hague motorway.

In France, where a large reduction in accidents followed the lighting of the Autoroute de l'Ouest, work has been completed on the lighting of the Paris Southern Motorway—the Autoroute du Sud. The twin lighting columns have been erected in the central reservation 35 metres apart, and carry two 400 watt fluorescent mercury lamps at 12 metres mounting height. The Southern Motorway carries about 40,000 vehicles a day and the cost of providing the lighting in terms of accident reduction in France is claimed to be justified where traffic exceeds 20,000 vehicles a day. (Fig. 2.)

Unfortunately, in Great Britain, no decision has so far been taken to light even a section of M1 and there is a great danger that this country, which has for long led in street lighting, may fall behind in the task of making motorways as safe by night as by day. Now that the Ministry has decided that anti-glare fences are not the solution for the glare problem on motorways, it is even more urgent that a trial length of lighting should be installed over a length of not less than 12 or 15 miles.

During the past year technical aspects of motorway lighting have been discussed at conferences and meetings arranged by the Association of Public Lighting Engineers, the Illuminating Engineering Society and the International Traffic Engineering Study Week in Nice, when lectures were given on visual aids to driving on motorways and other classes of highway.

In a paper Mr. J. M. Waldram presented at the Folkestone A.P.L.E. Conference, and reported in this Journal, on the effects on recent developments in road surfaces, he concluded that changes which have taken place will inevitably lead to installations of greater mounting height and lower space-height ratios, also that the power of installations will need to be increased to take account of the more matt surfaces being used.

Closely following this, in a critical analysis of visual problems of drivers on motorways, at a London meeting of the I.E.S., he showed how such problems had been studied by new techniques and compared with the problems on all purpose traffic routes. This paper was also reported in this Journal. After making it clear that vehicle headlights, as at present used, are quite inadequate for giving motorway drivers at night the sort of information they need for high speed driving, he showed that even with an intensity 40 times greater they would still be inadequate for the purpose.

Perhaps the two most important requirements he suggested for a system of lighting for motorways were:

(1) to show clearly the carriageway ahead sufficiently well to reveal any vehicles on it so that their position and closing rate could be judged, and

(2) that the rearward view should similarly permit the distance and closing rate of overtaking traffic to be judged in the mirror.

If these two conditions could be met at night there is no doubt that the accident rate would be much reduced.

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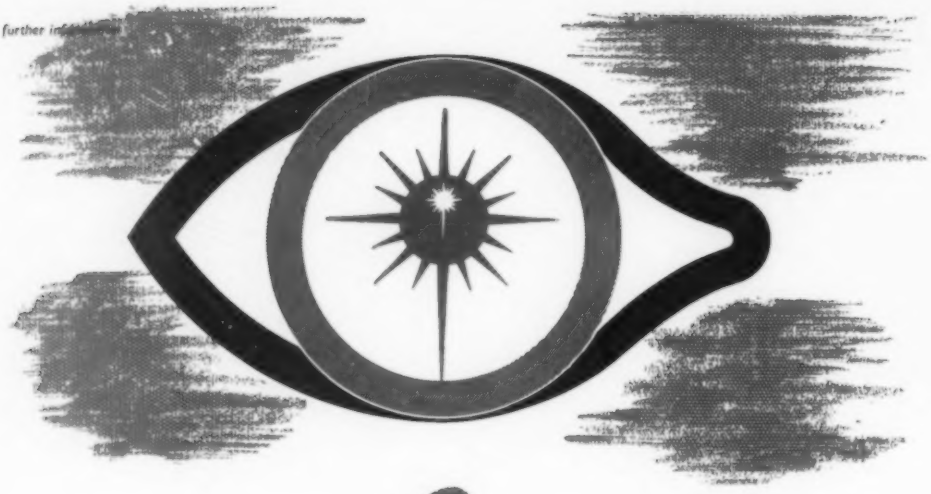

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Lanterns and Columns

Lanterns and columns of new and improved appearance have become available during the past year, and fibre glass columns are now used as side street lighting units in at least one city. Wall mounted fittings have been designed for special purposes, including semi-recessed fittings for sodium lamps for use in the Hook underpass.

In the American lighting field there have been a number of new developments in the past year, particularly in regard to the use of higher output lamps in tunnels and underpasses. A new standard kit has been designed for simplifying the conversion of filament lighting to mercury so as readily to allow existing installations to enjoy the increased light output of the mercury discharge lamp. The development of a new type of cut-off fluorescent lantern that eliminates glare and gives improved lighting on the carriageway seems to indicate that our American colleagues are at last coming into line with some of the Continental engineers who have for the past few years been concerned with the glare factor of fluorescent lighting—a view that is not yet generally shared in this country.

The use of fluorescent lighting in bridge railings and parapets has been tried out in the U.S.A., as well as in this country (Coventry), and may well point to the solution of some of our lighting problems on bridges and flyovers.

The publication during the year of 'Guidance Notes' for purchasers of street lighting lanterns and a new 'Code of Practice' for the erection of lighting equipment have also been evidence of the demand for better standards both of equipment and installation.

Developments in Urban Areas

Among the outstanding new installations in the last year must be included the lighting of the first section of the Birmingham Inner Ring, using post top lanterns (G.E.C.) mounted at 30 ft. and each housing three 400 watt colour corrected mercury lamps. (Fig. 1.) Also the new twin 200 watt linear sodium (A.E.I.) installations mounted at 35 ft. in Coventry, and the latest G.E.C. main road cut-off lantern for 250 watt or 400 watt colour corrected mercury lamps, designed for a spacing/mounting height ratio of 3:1.

Fig. 2. Paris: Autoroute du Sud by night.

One of the outstanding achievements in the past year has been the lighting with 5 ft. 80 watt fluorescent tubes of the Western Avenue underpass, which is the first of its kind sponsored by the Ministry of Transport.

The installation has met both the problem of avoiding motorists driving from daylight into a dark tunnel and conversely at night from a well lit tunnel into the somewhat lower level of lighting in ordinary streets. This has been achieved by the use of special concrete louvred canopies in the approaches to the tunnel that lessen the contrast between natural and artificial light—the night-time problem having been overcome by alternate lighting units being switched off so as to reduce the overall light intensity within the tunnel. (Fig. 3.)

Surveying Street Lighting

The theme of last year's A.P.L.E. Conference was the 'Changing Scene', and in the 'Survey of Street Lighting and its Future' by Stevens and Ferguson before the Institution of Electrical Engineers, they compared British and overseas techniques and standards and also described some recent installations and experimental work in France and Germany. In looking at British street lighting practice they claimed not only that the desire for good lighting on the roads continues to grow among both technical and lay people but also that the bulk of informed opinion is now in favour of lighting motorways. The quality of lighting on individual roads, they concluded, is not now good enough for the increased traffic because of the difficulty of lighting satisfactorily road surfaces designed with high skid-resistant properties.

In a recent paper, prepared for a joint meeting of civil, mechanical and electrical engineers in Kuwait, J. T. Grundy (A.E.I.) commented on the fact that the system of lighting roads in use in this country is now nearly 20 years old, and that with the advent of new anti-skid road surfaces the basic theory of street lighting is now having to be reviewed.

Although the B.S.I. Code of Practice Drafting Sub-Committee is at work, many lighting engineers have been quietly 'revising' the Code during the past two or three years, and the new 3 ft. linear sodium lamp is making an increasingly important contribution and providing installations of greater overall light output to meet the needs of modern road surfaces.

Although the last year has not seen any fundamental developments in the street lighting field, it has been a period of consolidation and new and better lighting installations are now appearing almost daily in town and country. They are increasing the contribution which good lighting is making to the reduction in accidents that arise on British roads after lighting-up time. In the year that lies ahead, however, it is to be hoped that the Ministry of Transport will face up to the administrative and financial problems that have for so long delayed the completion of the lighting of our national road system.

Fig. 3. View inside Tunnel, Western Avenue Underpass (G.E.C.).

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Bibliography of Traffic Engineering 3

For the Institution of Civil Engineers Traffic Engineering Study Group, Mr. A. G. Duff, Senior Engineer, Ministry of Transport, prepared a short bibliography of traffic engineering, incorporating the one originally compiled by the library of the Road Research Laboratory, Department of Scientific and Industrial Research, which has now made further revisions for its publication in Traffic Engineering and Control. The first two sections appeared in the February and March issues and the concluding one appears below.

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UNIVERSITY College has a long tradition in the varied fields of highway engineering and many of the standard pre-war textbooks, including 'Principles of Road Engineering' by Collins and Hart, were written by members of the College.

Traffic engineering as a topic in its own right is largely a post-war feature, but as early as 1937, traffic engineering was given considerable prominence at University College, and the traffic flow studies of Central London by Elliott and Houndsfield, in the late 1930's, are recognized as classics in their own field.

This tradition is reflected in the syllabus for the B.Sc. Honours Course in Civil Engineering which has a profound Highway & Traffic Engineering flavour.

Many of the aspects of highway engineering are covered under the main subjects, of which they form a part in second or final year viz. Soil Mechanics, Engineering Geology, Properties of Materials, Concrete Technology, Surveying, Law and Specifications. This allows the final year course of lectures in highway engineering to show a strong bias in favour of traffic engineering, which indeed comprises the bulk of the subject matter.

University College is fortunate in having situated at its doorstep perhaps the country's finest traffic laboratory—the West End of London—and of recent years, undergraduates have carried out traffic studies as part of their normal course of work in such places as Oxford Street and Hyde Park Corner. There have been also a number of post-graduate research studies in traffic engineering, particularly in relation to parking problems in the London area.

During the last two or three years expansion in the field of traffic engineering has been severely limited on account of lack of accommodation but new buildings are nearing completion and it is anticipated that this will permit rapid development of the traffic engineering section.

IMPERIAL COLLEGE

The post-graduate course in highway engineering at Imperial College includes the study of traffic flow and vehicle performance in relation to road design.

A specific problem is investigated each session at an actual site in Greater London, where improved planning is obviously needed. Typical examples of recent studies were the busy junctions at Hanger Lane and Western Avenue, prior to the construction of the recently completed underpass, and at Tolworth, on the Kingston By-pass. Team work is necessary for making preliminary topographical surveys and, in such traffic studies as directional counts, speed measurements and estimates of delays due to ineffective road design are made from data obtained on the site. Accident reports are also studied, with a view to eliminating dangerous traffic movements by such methods as channelization combined with signal control, or by grade separation.

Suggested reconstruction schemes, however, are the work of individual students who prepare drawings showing constructional details, together with explanatory reports and programmes for carrying out the improvement with the least possible interference with traffic. Approximate costs are estimated, and compared with forecasts of the possible savings resulting from the prevention of accidents and delays.

In addition to lectures in highway design and highway materials, and laboratory work in the latter, students attending the course are able to take lectures in soil mechanics, concrete technology, structural design, geology and statistics.

Students applying for admission to the course are normally required to have an engineering degree from an approved university and those whose work during the session is of a satisfactory standard are awarded the College Diploma (D.I.C.) in Highway Engineering.

The Rees Jeffreys Trustees endow three bursaries annually in connection with the course.

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Harry Dimmock buys a Queen

(Dimmock & Seal, Hauliers)

Cheviot Queen is climbing Shap on the A6 to Carlisle: *Lakeland Queen* is pounding up the motorway with a load of machine tools: and now *Border Queen*—youngest of them all—is off to Warrington with 183 miles to do and a shocking wet night to do them in. Like her sisters (fifty-four of them now) *Border Queen* was bought with UDT's help. Perhaps that surprises you? HP's fine for penniless newly-weds, you might think, but surely a prosperous firm like D & S could afford to pay cash? Of course they could—but they prefer not to. *Border Queen*, thundering up the Great North to Gateshead, down A30 to Exeter, along M1 to Coventry, earns her keep and more. So her purchase becomes a simple entry in the company accounts, with payments, plus road tax, insurance, major overhauls and even a set of new tyres (all financed by UDT), set against the extra profits she brings in. All tidily arranged with no messing about with capital.

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INDUSTRIAL NEWS AND INFORMATION

A WELCOME first step towards a more objective official appraisal of the noise nuisance has been taken by the London County Council, who, in conjunction with the Building Research Station of the D.S.I.R., have initiated the most thorough noise investigation ever undertaken. The object is nothing less than a complete and detailed survey and analysis of noise levels throughout the whole of central London, an area of 36 square miles stretching from Hampstead to Camberwell, and from Wandsworth to Greenwich. The L.C.C. work is performed by a team led by Dr. R. J. Stephenson of the Council's Scientific Advisers' Branch. They are making use of a combination of field and laboratory techniques combining accuracy with practical results. The field equipment consists of a Dawe Type 1405A objective noise meter with associated power unit, and of a Type 1406D high-speed level recorder, used in conjunction with a high-fidelity tape recorder.

The objective noise meter was designed to meet the new International Electrotechnical Commission requirements. It provides greater accuracy throughout the audio range than earlier instruments, and is designed to operate in conjunction with a wide range of other equipment, such as analysers, recorders and oscilloscopes. In this investigation the meter is set to the 'A' weighting network, thus giving a close linear relationship to phon values at the levels typical of traffic noise.

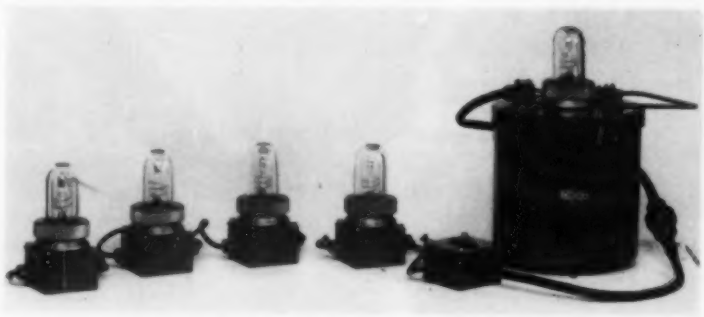
The rapid variations in noise level occurring in this kind of survey could not reliably be recorded by noting the meter readings. The noise is therefore recorded for later study in two ways: the output of the noise level meter is passed to the tape recorder and to the high-speed level recorder. The latter uses a sapphire stylus to record sound level on a waxed-paper strip chart, calibrated directly in decibels. It operates on the 'null balance' principle, a servo circuit varying the setting of an input potentiometer to maintain a constant output level. The moving-coil movement which adjusts the potentiometer also moves the recording stylus, so that its displacement is proportionate to the variations in input sound level. This system not only makes the instrument independent of circuit-constant variations, but makes possible extremely high response speeds of up to 100 cm/sec, corresponding to 1,500 dB/sec. Despite this high speed, damping is so efficient that 'overshoot' is negligible, and the overall accuracy is between 0.5 dB and 1.5 dB, depending on which of a number of ranges is selected.

The charts are later analysed in the laboratory, to produce tables of mean, minimum and maximum overall noise levels at the various locations at different times of day.

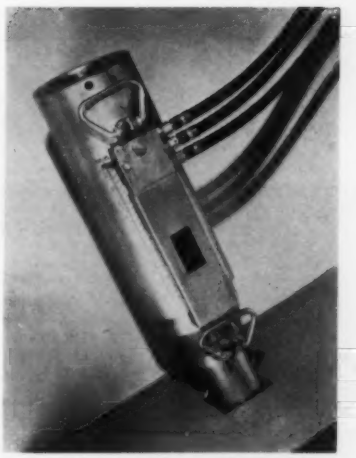
The objective noise meter is also used to drive the tape recorder, although in this case a modification to the meter allows the output to be taken from an early amplification stage, giving unweighted characteristics over a very wide band. The tape is analysed in the laboratory by playing it back through an octave band filter and re-recording the result on the high-speed level recorder, for analysis. The results of the octave band analysis are used to correct the weighted wide band recordings according to the Stephens method for converting dB to phons. The octave band analysis is used for the investigation of selected sections of tape and to provide a basis against which the bulk of the wide-band noise is examined.

The survey is still in its early stages. It will be a long time before the results can be put to practical use.

T.E.C. 189 for further details



The Londex Master Beacon and Slave Lamps.



A Gifford-Burrow Jack.

Gifford-Burrow Prestressing Jack

Prestressed Sales Ltd. have announced that a new high pressure, large strand jack is available for hire or purchase. The first of these jacks is already being used by Marples Ridgway & Partners on the construction of the Hammersmith flyover.

By using working pressures of 10,000 lb. per square inch, it has been possible to design the jack to provide a maximum jacking force of 77.5 tons and yet weigh only 96 lb. It is claimed to be the most advanced piece of equipment of its type and simple to operate. The low weight of the jack means that it is easily handled by two men and it requires no special lifting gear.

The 10 in. stroke model of the jack is approximately 24 in. long over the temporary grip at the back and is 6½ in. in diameter. The jack can be supplied with an independent electrically operated or petrol driven pump unit.

T.E.C. 190 for further details

Marking Road Obstructions

To take the place of the usual oil burning lamps, a battery powered flasher is now available for marking obstructions in the roadway. The Londex portable obstruction light, as it is called, is also supplied as a master unit with a number of slave units to show the exact extent of the obstruction.

The master beacon has as a light source a Londex cold gas discharge lamp, which flashes either 60 or 90 times per minute. The natural colour of the lamp can be red, green or white and

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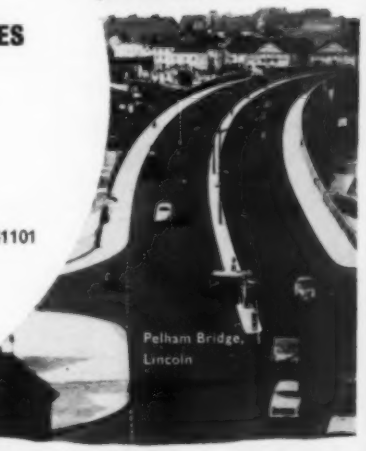

Pelham Bridge, Lincoln

Tarmac Garaging Service (TAGS)

Barber-Greene Spreader

Ross By-Pass and Ross Tewkesbury Motorway (Contract No. 1)

it is enclosed in either a glass dome or 100 mm. lens. The flashing mechanism is an electro-magnetic impulse generator producing a high voltage impulse which results in a flash of great intensity. The casing is fabricated from heavy gauge steel and a strong handle is provided for easy carriage. The gas discharge lamp is claimed to run for a number of years without attention and the impulse generator is expected to serve a similar period. The slave lamps, each of which comprises a light tube and housing mounted on cable connection box, flash in unison. Up to four of these smaller units can be fed from one master beacon and when all are in use a life of four to five hundred hours can be expected from the two six volt batteries.

T.E.C. 191 for further details

The Winlite Bollard.

The Winlite Bollard

As an addition to their existing range of street furniture, Winsser Signs Ltd. are introducing a glass-fibre road bollard. This unit, to be known as the Winlite, is moulded in one piece. By a special process, the opaque portions of the bollard are integrally moulded with the translucent panels. As a result no form of sealing is necessary and the panels contribute markedly to the strength of the structure which, on a strength/weight ratio is equivalent to that of steel. The main body of the bollard is constructed of unfilled polyester resin reinforced with glass fibre, whilst the opaque portions contain a light fast pigment with a high degree of resistance to ultra violet rays dispersed in polyester resin. The legend 'KEEP LEFT' is incorporated at the time of moulding and is contained within the laminate to a variable depth. The advantages of screening on either the internal or external face are therefore eliminated. The dimensions of the new bollard are:

Weight: 20 lb. including lighting unit.
Overall height: 42 in.
Overall width: 13 in.
Overall depth: 10 in.
Total area of translucency: 3 sq. ft.
Size of access opening: 9 in. x 32½ in.
Size of 'KEEP LEFT' panel: 9 in. x 12 in.

The design of the method of fixing the bollard to the brackets is such that under impact the bollard will shear from its retaining bolts. The nature of the material will then allow it to bounce clear of the vehicle striking it, without excessive damage either to the vehicle or itself

T.E.C. 192 for further details

Case W.5 Terraload'r

Recently released to the British market are details of the new Case W.5 Terraload'r, a front-wheel drive loading shovel with power assisted steering to the rear wheels. It has a one cubic yard bucket, torque converter drive and is powered by a 57 h.p. Case diesel engine. The technical specifications indicate power-operated shuttle transmission which gives on-the-go gear shift through four forward and four reverse speeds—up to 18 m.p.h. forward and 23 m.p.h. in reverse. Power-assisted steering allows a 360° turn in a 10 ft. 5 in. circle. Sixty per cent of the machine weight is carried by the rear wheels to allow optimum balance when the machine is travelling loaded or empty.

T.E.C. 193 for further details

Pins for Cat Rippers

A new two-piece quick change pinning device for securing tips on Caterpillar rippers can be installed or removed within one minute, using only simple hand tools. Each pin, semi-circular in section, is bent slightly at the centre to achieve the locking effect, and is flanged at each end. Pins are installed back-to-back. Because of the inherent wedging action, they are installed or removed only one at a time. The new pins will fit all Caterpillar ripper shanks now in the field. Elongated holes are required in ripper tips used with the new units, however, and this change is incorporated in all tips now being produced. In addition to the ease and simplicity of installation and removal, the new pins are virtually unbreakable, having more than twice the strength of previous rivets. The high strength results from through-hardening the alloy steel forgings.

T.E.C. 194 for further details

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The Nev'eye Camera.

Closed Circuit Television

The new Nev'eye closed circuit television camera, designed and developed by the Nottingham Electronic Valve Co. Ltd. is claimed to be the cheapest by far of any yet made. Its low price is made possible by the use of modern circuit design, transistors and semi-conductors. It has been designed to work into any standard domestic television receiver from ordinary mains supply and is so simple that it can be operated by the least technically minded.

The output from the camera is a composite modulated radio frequency signal, and can be tuned to any channel in Band 1. Synchronizing impulses and blanking impulses are derived within the camera and are mixed with the vision signal to form a composite wave form which will lock any standard receiver working on the British 405 line system or, alternatively, on the Continental 625 line system. The whole camera, which weighs 12 lb., is housed in a louvred steel case, measuring 11½ in. x 5½ in. x 6¾ in. and fitted with a ¼ in. tripod bush. The simplicity of this new camera makes it, it is claimed, the ideal unit for use in a number of applications. Traffic control and observation is one of the uses primarily considered by the designers.

T.E.C. 195 for further details

Double-Beam Oscilloscope

Solartron Laboratory Instruments Ltd. have announced their first rackmounted double-beam oscilloscope CD 1016. This small and compact double-beam instrument combines all the features normally associated with larger, higher priced oscilloscopes.

The CD 1016 has two identical Y amplifiers, bandwidth of D.C. to 5 Mc/s (−3 dB), with a rise time of approximately 70 μsecs. Nine calibrated sensitivity ranges, switched in

CD 1016 Oscilloscope.

TEC487 *for further information*

IMPORTANT ANNOUNCEMENT

HILLS

PARKING METER

The Hills' Parking Meter (the British-made version of the world-famous American Duncan Miller Meter, Model "60", which has been adapted to comply with Ministry of Transport Specifications) is now available in this country.

What are the **FACTS** about this meter? Here are a few:

1. In the United States alone, 20,701 automatic type meters were replaced by this manual type meter in the year 1960.
2. Because it is manually operated it gives TROUBLE-FREE and FAR LONGER LIFE.
3. World-wide experience has proved that it requires the MINIMUM of MAINTENANCE.
4. The United States has 600,000 in operation—as many as ALL the other makes combined.
5. 2,000 towns and cities all over the world are using this meter. They include :

AUCKLAND	HAMILTON	MALMO	REYKJAVIK
ATLANTIC CITY	HANOVER	MIAMI	ST. LOUIS
BALTIMORE	HELSINKI	MONTREAL	SACRAMENTO
CHICAGO	HONOLULU	NEW ORLEANS	SALT LAKE CITY
CINCINNATI	INDIANAPOLIS	NEW YORK	SAN DIEGO
DENVER	INVERCARGILL	OMAHA	SAN JUAN
DES MOINES	IOWA CITY	OSLO	SPRINGFIELD
DETROIT	KANSAS CITY	OTTAWA	STOCKHOLM
EL PASO	LAS VEGAS	PITTSBURGH	WELLINGTON
HAMBURG	LOS ANGELES	QUEBEC	WINNIPEG

Further information from Hills (Patents) Ltd., Parking Meter Division, Atalanta Works, London Road, Staines, Middx. • Staines 55041 (6 lines)

1 – 2 – 5 sequence, cover 100 mV/cm with ± 5 per cent accuracy, and a fine control gives continuous coverage up to approximately 100 V/cm. The integral A.C. preamplifier preceding Y_2 gives six additional sensitivity ranges with a maximum sensitivity of 1 mV/cm. The input inpedance is 1 MΩ and 30 pF, and inputs may be 'floated' up to 500 V (+ve or −ve) relative to chassis for displaying signals isolated from earth. The time base covers 1 cm/μsec to 2 cm/sec. in 18 calibrated ranges, in 1 – 2 – 5 sequence with plus or minus five per cent measuring accuracy. A fine control with a calibration position gives continuous coverage to 1 cm/sec. The maximum sweep speed of 5 cm/μsec may be obtained by using X expansion. The oscilloscope may be triggered internally or externally (+ve or −ve) on TV frame, TV line, Auto or Normal modes and 'Level' and 'Stability' controls permit accurate and reliable triggering at a selected point on the displayed waveform. A 'bootstrap' type time-base is employed giving a linearity better than one per cent, and the time-base waveform (10 V pk-pk) is available at a socket on the front panel.

Direct access to the amplifier is available for external signals. A 30 volt bright-up pulse derived from a separate bi-stable circuit, coupled to the cathode ray tube, gives bright displays at all sweep speeds. Provision is also made for external brightness modulation. A square wave of ½ volt pk-pk ± one per cent, at mains frequency, is available for calibration of the time-base and Y sensitivity. Stabilized E.H.T. enables calibration accuracy to be maintained regardless of brightness levels. A 3½ in. diameter double gun c.r.t. type 3AZP31 is used. The mains input is 100-125 V/200-250, 45-66 c/s.

T.E.C. 196 for further details

The Beam-handling Truss described below.

Truss for Launching Beams

In the construction of the Wolvercote Viaduct on the Oxford By-Pass, the main contractors, Messrs, Higgs & Hill, used a beam-launcher of a type not before seen in this country. Manufactured by Head Wrightonson, Stockton Forge Ltd. the launcher consists of an inboard mast, made of mild steel, an aluminium alloy truss and outboard mast. The alloy truss, weighing 4½ tons, has a triangular cross section and the lowest member is a special extension which performs the dual role of truss-member and monorail. Both the outboard and inboard masts can be slewed in relation to the line of the truss, which is launched across the open span by using one of the concrete beams as a kentledge. Movement of the whole beam-launcher is controlled by a winch attached to the inboard mast. Beams of up to 67 ft. and weighing 38 tons have been positioned across existing carriageways, with virtually no interference to the traffic using the road below.

T.E.C. 197 for further details

Aluminium Shelters

Rollalong Ltd. have recently introduced a new site cabin that is light enough for one man to be able to winch it on to a trailer. This new shelter is 12 ft. long, made of aluminium fully insulated with hardboard covered with plastic. It is fitted with a metal-framed window at one end and a door at the other. The manufacturers are able to supply these cabins fitted out to serve a number of purposes such as diners, ablutions, offices or bunkhouses. The overall weight of the 12 ft. unit is only 8 cwt. As an extra, a trailer can be supplied for easy transport from site to site.

T.E.C. 198 for further details

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CONGRESS OF TRAFFIC POLICE

The Third International Congress of Traffic Police, organized by the Associazione Nazionale Via Sicura and the International Federation of Senior Police Officers (I.F.S.P.O.), with the co-operation of the World Touring and Automobile Association (O.T.A.), is to be held in Rome May 22-27. The themes for discussion include 'Relations between Road Users and the Police'. 'Study of Legibility of Different Types of Vehicle Registration Plates', and 'Technical Means of Detecting Offences'. A Forum will deal with the 'Problem of Traffic Accident Investigations', 'Pedestrian Traffic', and 'Selection and Training of Traffic Police Personnel'.

CORRECTION

In the article on Saturation Flow at Light Controlled Intersections by Brian Helm in the April issue, two equations were transposed. Equation 11 on page 722 should have been placed where Equation 6 appeared on page 723 and the repetition of Equation 6 in the conclusions should have preceded Equation 8.

SUMMER SCHOOL AT DURHAM

From July 20-23 the Northern District of the Institution of Municipal Engineers is to hold a Summer School at Durham, based on the general theme 'Improving Environment' with one of the three lecture days devoted to 'Communications and Traffic'. Contributors to this session include Professor W. Fisher Cassie, who will speak on 'City Traffic—Scientific Method *v.* Subjective Impressions', Mr. N. H. Stockley on 'The Design of Urban Traffic Routes' and Mr. Granville Berry on 'Solving Road and Traffic Problems in the Central Area of Coventry'.

TOWN PLANNING CONFERENCE

At the Thirty-Fifth Annual Conference of The Town Planning Institute to be held at Llandudno, May 31 to June 2, among the papers which will be of particular interest to those concerned with the planning of roads and traffic is one to be given on May 31 by Mr. J. L. Womersley, City Architect, Sheffield on 'Housing the Motor Car'. The panel for the President's Forum on June 1 includes Sir William Holford, President of the R.I.B.A., Mr. S. D. Trustram Eve, President of the Royal Institution of Chartered Surveyors, Sir Herbert Manzoni, President of the Institution of Civil Engineers and Mr. Arthur S. Hamilton, President of the Institution of Municipal Engineers, with Mr. Rowland Nicholas, President of the Town Planning Institute in the Chair. Other papers for discussion include 'Planning at the Crossroads' to be presented by Mr. Lewis B. Keeble, Director of Studies, Department of Town Planning, University College, London, and 'The Design of Shopping Centres' by Mr. J. Seymour Harris.

SOLUTION TO CROSSWORD NO. 10

The present series of Crosswords ended with the publication of No. 10 in the April issue, the solution of which is given here.

W	I	L	L	I	A	M	■	H	O	L	F	O	R	D
A	■	E	■	R	■	I	■	O	■	E	■	P	■	O
T	E	N	N	I	E	L	■	V	I	O	L	E	N	T
E	■	T	■	S	■	I	■	E	■	P	■	N	■	E
R	E	I	N	■	S	T	A	R	G	A	Z	E	R	S
S	■	L	■	S	■	A	■	S	■	R	■	R	■	■
H	E	S	I	T	A	T	E	■	A	D	U	S	T	S
E	■	■	■	A	■	E	■	A	■	C	■	■	■	U
D	E	S	I	G	N	■	O	C	E	A	N	I	A	N
■	■	P	■	E	■	S	■	C	■	T	■	D	■	B
T	R	A	F	F	I	C	C	U	T	■	C	O	W	L
H	■	R	■	E	■	A	■	R	■	T	■	L	■	I
A	R	R	I	V	A	L	■	A	R	R	A	I	G	N
W	■	O	■	E	■	E	■	T	■	I	■	S	■	D
S	E	W	E	R	E	D	■	E	X	P	R	E	S	S

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